RAILWAY MECHANICAL ENGINEER

Founded in 1832 as the American Rail-Road Journal

With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, Railway Master Mechanic, and Boiler Maker and Plate Fabricator. Name Registered, U. S. Patent Office.

"There is no stalemate of diminishing interest in railway problems but rather a stepping up, an increasing efficiency, a newness amounting to actual genius. Abiding in the men who have had their share in this general uplift there must be a feeling of elation, of adventure, and of that deep satisfaction which compensates far beyond monetary award. And it is certain that that character of man, having achieved this day's success, will not be content to rest on present laurels, but rather will go on to still higher achievement."

Ralph Budd,
President, Burlington Lines

See page 207

● ● ●

Published on the second day of each month by

Simmons-Boardman Publishing Corporation

1309 Noble street, Philadelphia, Pa. Editorial and Executive Offices: 30 Church street, New York, and 105 West Adams street, Chicago. Branch offices: Terminal Tower, Cleveland; 1081 National Press bldg., Washington, D. C.; 1038 Henry bldg., Seattle, Wash.; Room 1001, 485 California street, San Francisco, Calif.; 530 W. Sixth street, Los Angeles, Calif.

Samuel O. Dunn, *Chairman of Board; Chicago;* Henry Lee, *President, New York;* Lucius B. Sherman, *Vice-Pres., Chicago;* Roy V. Wright, *Vice-Pres. and Sec., New York;* Frederick H. Thompson, *Vice-Pres., Cleveland;* Elmer T. Howson, *Vice-Pres., Chicago;* Frederick C. Koch, *Vice-Pres., New York;* Robert E. Thayer, *Vice-Pres., New York;* H. A. Morrison, *Vice-Pres., Chicago;* John T. DeMott, *Treas. and Asst. Sec., New York.*

Roy V. Wright
Editor, New York

C. B. Peck
Managing Editor, New York

E. L. Woodward
Western Editor, Chicago

H. C. Wilcox
Associate Editor, New York

W. J. Hargest
Associate Editor, New York

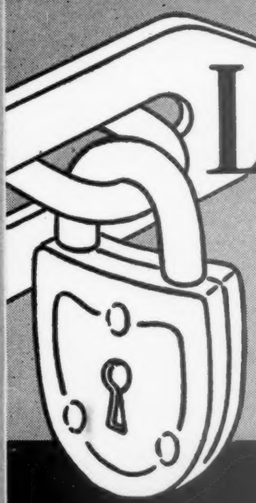
Robert E. Thayer
Vice-Pres. and Business Manager, New York

Subscriptions (including, when published, the daily editions of the Railway Age, published in connection with the convention of the Association of American Railroads, Mechanical Division), payable in advance and postage free, United States, U. S. possessions and Canada: 1 year, $3; 2 years, $5. Foreign countries, not including daily editions of the Railway Age: 1 year, $4; 2 years, $7. Single copies, 35 cents. Address H. E. McCandless, circulation manager, 30 Church street, New York.

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.), and is indexed by the Industrial Arts Index and also by the Engineering Index Service.

June, 1938

Volume 112 *No. 6*



A Record of Remarkable Accomplishment

This issue presents a review of recent striking accomplishments and the present trends in railway transportation. It evaluates the part which mechanical departments and the designers and developers of motive power, rolling stock and auxiliary equipment have taken in bringing them about. There is presented a remarkable picture of new materials, of interdependent and simultaneous refinements in design of motive power and rolling stock, and of new types of facilities. Not the least remarkable part of the picture is the evidence of vision in the railway industry presented by the way in which all of these newly available improvements and facilities have been adapted to the new competitive situation of the railways and to their need for economy.

The outstanding characteristics of modern railway transportation service, to which these mechanical advancements have contributed, are increasing speed, greater reliability and economy of train performance and increasing sensitiveness to the public taste.

The railroads owe the present movement for increasing passenger-train speeds to new Diesel-driven lightweight streamline passenger trains. These trains have demonstrated two things: The importance of an adequate power-weight ratio for maintenance of fast schedules, and the high availability and relative freedom from service delays of the Diesel locomotive.

But the steam locomotive is also capable of high speeds. Better counterbalancing and the increasing concentration of horsepower capacity in the modern steam locomotive have retained for it its long established position of an all-round motive-power unit, whether for the fastest passenger service or the heaviest freight service.

Running speeds of freight trains have also been increased. This is evidence of the increasing mechanical reliability of freight-train cars. Contributing to increasing speeds in both services are the new air brake equipments.

Improvements in reliability of both motive power and rolling stock have contributed materially to the increase in economy of train performance. Increasing capacity and efficiency of the steam locomotive have also been large factors in this direction. Indeed, the greatest value of higher efficiency lies in the increased capacity which it makes available for moving heavier trains faster. Better freight-car designs are keeping cars off the repair tracks and reducing dangerous failures in service. Freight cars of lighter weight and higher ratios of lading capacity to gross load promise definite and worthwhile savings in operating expense.

All of these developments have depended upon improved materials which have become available at various times during the past ten years. Among these materials are the alloy boiler steels, the aluminum alloys and stainless steels which have been employed in passenger-car construction, and the low-alloy, high-tensile structural steels which are being used extensively in the building of both passenger and freight cars. Special alloy steels for locomotive forgings are giving new impetus to the lightening of reciprocating parts of the steam locomotive, and alloy-steel truck castings are contributed to the reduction of the passenger-car and freight-car weights.

In passenger service, the growing sensitiveness to the public taste is evidenced in many ways. In addition to its own contribution to comfort, air conditioning has permitted a range of choice in color and decorative treatment which has opened an entire new field to the interior decorator. Streamlining, which possesses some economic advantages at high speeds, has really become a term which signifies exterior styling of passenger cars and locomotives. It has endowed high speed with glamour and has done much to restore the long dormant popular interest in the railway.

The accomplishments in a field of motive power and rolling stock include improvements in maintenance as well as in operation. The modern steam locomotive has many features built into it which are coming to spell reduced maintenance. Improvements in the shops are also being made which will increase still further the economies in maintenance expenses which have been effected in recent years by more systematic attention at terminals and better organized and more specialized operations in the shops.

The accomplishment as a whole is one which all those, either on the railroad or in the supply and equipment industries, who contributed to it may regard with real satisfaction. It is of a nature which promises continued progress in the future.

The Mechanical Department's

Contribution to Railway Progress

By Ralph Budd
President,
Burlington Lines

WHAT has been the contribution of the mechanical department to railroad progress? As we glance back a bit at the actual accomplishments of only the past few years and consider what is now in the making we realize that somewhere there must be a body of men whose activities in designing, building, running and maintaining our new style light-weight high-speed passenger trains are distinctly contributing to railway progress. That same body is also active in the improvements that have lately come to steam locomotives and their handling and repairing, and have had to do with Diesel locomotives, for it should be borne in mind that a Diesel engine, as such, is not a locomotive any more than it is a boat. That body is also the presiding genius of the activities surrounding our improved freight cars, improved shop tools and improved methods and devices almost endless and without number.

Men with Ideas

The men comprising this body have ideas. Perhaps a better way to express it is that men who have ideas are those who compose this body, regardless of how far down the line they may seem to themselves to be. Why should anyone be surprised that a railway mechanical man, with his reasoning processes on specific matters brought to a keen edge through his daily struggle with adverse factors and emergencies of varying character, should have ideas? It is under such circumstances that creation most often has its being: Such an atmosphere is a very mother of ideas. Many a creation first saw the light of day in the remote recesses of a roundhouse, or locomotive shop, or car shop, or drafting room; and the cumulative effect of a constant flow of ideas, of improvements large and small originating largely on the railroad itself, refreshing its being and assisting it in maintaining its position as a transportation machine against the keen competition it faces must of necessity contribute enormously to railway progress.

Noteworthy Accomplishments

And what this body of men has wrought! Streamlined light-weight trains and semi-light-weight trains of surpassing quality and merit, air conditioned, artistic and luxurious, fine riding at the highest speeds, are making good in the most exacting high-speed railroad service the world has ever known. Trains of glittering stainless steel, of aluminum alloy, and of the lesser alloys; made possible first by the metallurgist in producing materials better suited to the purpose, secondly by the devisors of methods for working and fabricating these alloys to the best advantage, and lastly by experienced designing engineers who proportion the structure and shape the material to the load, taking due heed of its virtues, not forgetting its failings, and remembering that every surplus pound of weight saved gives continual saving in operating expenses throughout the life of the train. While there may be divisions of opinion as to what material and what construction is the most worthy as a durable mechanical structure and the most appealing as to artistic satisfaction or glamour, let it be borne in mind that all these trains are receiving high public approval and are building up a renewed public interest in and consideration for the railroads, as such.

Brakes Make High Speeds Possible

What travels fast must be stopped fast if safety is to be furthered and it is comforting to know that the advance in brake efficiency has kept pace with the advance in travel speed. Electric in operation and instantaneous in response these brakes are designed to give maximum shoe pressure at high speed, tapering off to reduced shoe pressures at lower speeds, all in reverse step with the increasing coefficient of friction between the shoe and the wheel as the train slows up. Then, too, we have close in the offing some promising, even radical, improvements which, if their day-by-day performance continues as good as their test performances, should very greatly improve braking performance. One of these is the use of disc, or drum, brakes which, in addition to taking the brake shoe pressure away from the tread of the wheel and increasing its life thereby, also provides a higher retardation possibility than at present. Another development is a wheel anti-skid device which automatically removes the brake pressure from a skidding wheel, holding it in abeyance until the wheel comes back to normal speed, at which time it is automatically reapplied.

The "Iron Horse"

Steam locomotives, both freight and passenger, now have greater speed, power, fuel economy, availability and general worth than the locomotives of a few years ago. In the design of these locomotives an ever increasing consideration for the track—that uncomplaining member of the railroad family—is coming to the fore and is in keeping with a more intelligent use of the existing railroad facilities. Counterbalancing methods have been improved and, what is even more to the point, a renewed interest in reduction of weight of reciprocating parts is manifesting itself. Weight distribution to the various locomotive wheels is now more often made with an eye to causing less shock and distortion to the track as the locomotive rolls along, an easing of the locomotive into the track so to speak. Driving wheels are made larger with resulting benefit to both track and locomotive; because in making less revolutions per mile the rails receive fewer and lessened dynamic impacts, the revolving and reciprocating parts are subjected to less wear and there is an improvement in steam distribution and cylinder horsepower due to the slower movement of the piston valve in relation to train speed.

Whether for better or for worse, it is becoming a conventional practice to streamline, or smoothline, locomotives assigned to high-speed passenger service. Roller bearings are aiding in cutting down the cost of maintenance and in keeping the locomotive out of the roundhouse. There are locomotives in this country today that are 100 per cent roller bearing; roller bearings being used on all axles, all crank pins, the crosshead and the valve gear bearings.

The use of steam for prime movers is being energized in no uncertain way and it is fair to assume that the coming of the Diesel locomotive, with its economy in operation and its high availability for service, has had something to do with this new pep. The railroads are fortunate indeed in being in a position to benefit from this new rivalry.

Light-Weight Freight Cars

Freight cars of alloy steel are now being built for the double purpose of reducing dead weight and reducing the ravages of rust. For a reasonable advance over the cost

of conventional carbon steel an alloy can be had which will not only substantially slow down the rusting process but which, because of its higher physical qualities, will carry greater load per pound of material. It is interesting to note too, how direct and simple are some of the designs of today when compared with equipment of an older school. Improvements have been made in the springing of freight cars to such an extent as to reduce complaints of shippers and claims for damage.

These considerations and other evidence indicate that there is no stalemate of diminishing interest in railway problems but rather a stepping up, an increasing efficiency, a newness amounting to actual genius. Abiding in the men who have had their share in this general uplift there must be a feeling of elation, of adventure, and of that deep satisfaction which compensates far beyond monetary award. And it is certain that that character of man, having achieved this day's success, will not be content to rest on present laurels, but rather will go on to still higher achievement.

High Speed and High Traction Characterize

Modern Motive Power

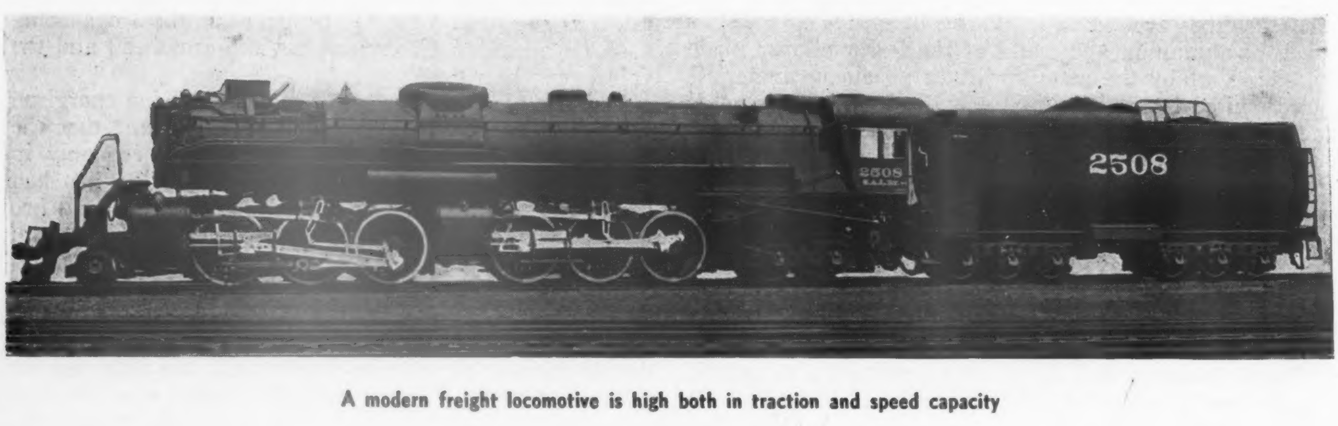
Diesel passenger locomotives grow to 5,400 engine horsepower — Horsepower capacity per driving axle of steam locomotives continues to increase as the result of better boiler proportions — Mechanical refinements and stamina keep pace with growing capacity

LOCOMOTIVE capacity has always been the key to economy in train operation. This was true in former days when direct tonnage rating and locomotive tractive force were the sole yardsticks. It is still true today when ton-miles per train hour and locomotive horsepower are the units of measurement.

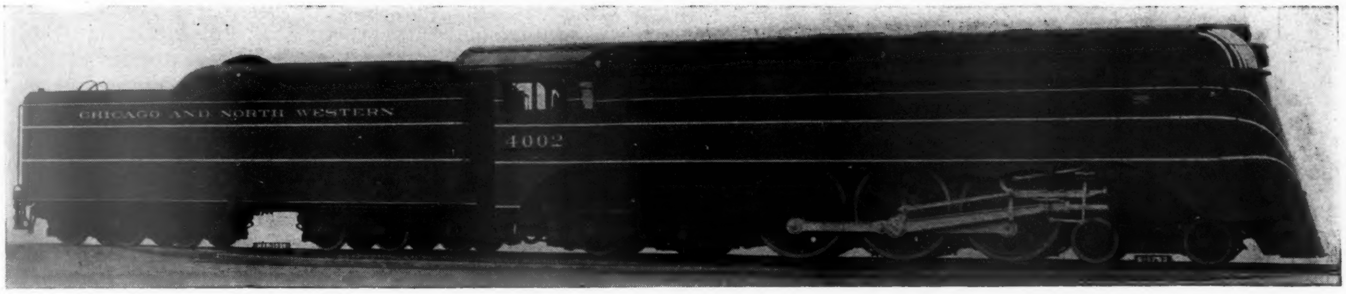
Train-operating expenses run so largely by the mile or the trip that the greatest field for economy in train operation has always been the reduction of train-miles. This means more tractive force. During the period of intensive development in locomotive economy, effected by the so-called economy- and capacity-increasing devices, overtime became an important factor in train-mile costs. Increased fuel and water economy were, therefore, converted into increased horsepower output and increased freight-train speeds. A new unit for measuring train performance became current—gross ton-miles per train hour.

Greater tractive capacity and heavier trains increased gross ton-miles per train hour, but did not reduce overtime. Resort could sometimes be had to reducing tonnage to increase gross ton-miles per train hour and to reduce overtime. But such an adjustment increased train-miles and so did not help much in reducing the direct costs of moving a given volume of freight traffic.

From being a by-product of improvements in economy increased horsepower capacity has become a major objective in its own right. During the 13 years since the introduction of the four-wheel trailer and the enlarged firebox there has been a steady advance in horsepower capacity as new freight locomotives have gone into service. Train speeds have been increased and so have the train loads. The modern locomotive in freight service moves more tons over the road in fewer hours, thus effecting marked increases in gross ton-miles per freight-



A modern freight locomotive is high both in traction and speed capacity



A fast, streamline passenger locomotive built for the Chicago & North Western by the American Locomotive Company

train hour and reducing crew overtime. In 1922 the crew overtime hours paid for in through-freight-train service on Class I railroads averaged more than 25 per cent of the straight time worked. In 1937 this had dropped to about 5 per cent of the straight time worked. During the same period average freight-train loads have increased from 1,466 to 1,902 tons (30 per cent) and average gross ton-miles per train hour from 18,200 to 30,349 (67 per cent). Thus, again, the increasing capacity of the steam locomotive—this time, the capacity for higher sustained speeds without sacrifice of train load—is the measure of its increasing potential operating economy in freight service.

In passenger-train service horsepower has always been the measure of locomotive capacity. The increasing weight of cars and number of cars in through trains has placed a steadily increasing demand for greater passenger-locomotive horsepower throughout much of the past 30 years. With that has now come the movement toward higher scheduled passenger-train speeds. The combined effect of these two demands is to require high tractive capacity with great horsepower capacity.

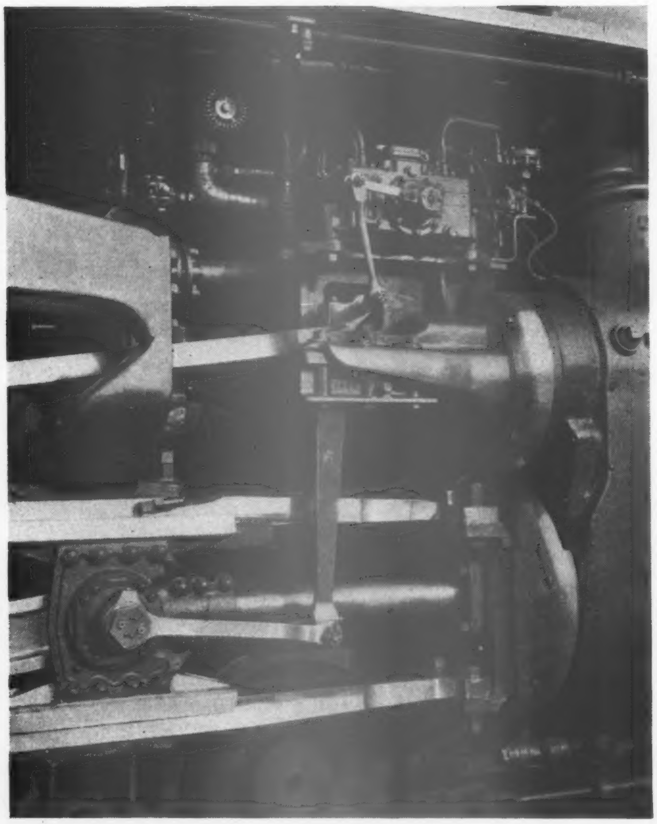
It will be observed that there has been a decided narrowing of the differences in characteristics of freight and passenger locomotives. Heavy passenger power now approaches the freight power in tractive capacity and freight power approaches passenger power in boiler and horsepower capacity.

Diesel-Electric Locomotives

With the introduction of lightweight streamline passenger trains there began an extension of Diesel-electric motive power into passenger-train service. With the early short trains the power plant was installed in the front end of a revenue vehicle. The demand for increased revenue capacity, however, soon increased the load to the point where full Diesel-electric locomotive units were required. From the 600 hp. rail-motor car, the motive-power units have grown to 1,800 and 2,100 hp. in single-unit locomotives to 3,600 hp. in double-unit locomotives and 5,400 hp. in triple locomotive units.

The novelty of the Diesel motive power is the basis for a part of the glamour which has been created around some of the lightweight articulated high-speed trains. Entirely aside from this factor, however, these locomotives have other useful qualities, such as the ability to operate for long distances without the need of stops for servicing and the ability to have necessary maintenance work done piecemeal without removing the locomotive from service.

A 5,400-hp. Diesel-electric locomotive in three units built for the Union Pacific by the Electro-Motive Corporation



High-tensile alloy steels and refinements in design are the features of modern light reciprocating parts

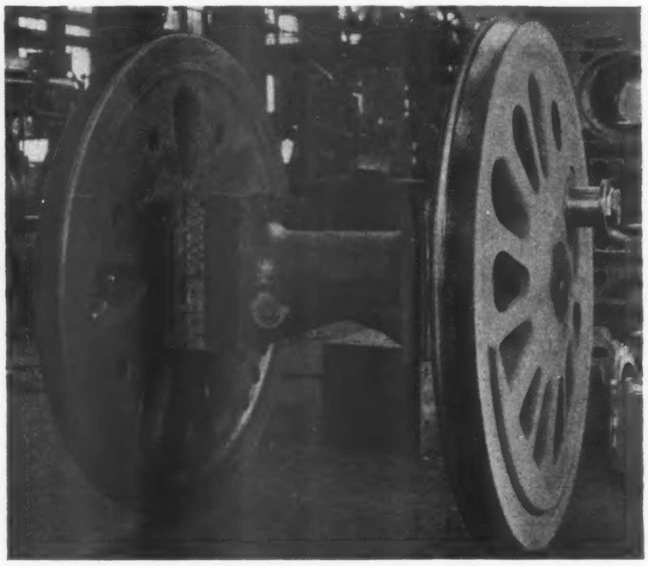
The position of the Diesel-electric locomotive in switching service is well established. Notwithstanding the present full-crew requirements, its high availability, high rate acceleration at low speeds and freedom from stand-by losses where the active work is intermittent adapt it to many yard and transfer jobs. So far as the cost of maintenance is concerned, adequate data, by which convincing comparisons can be made between Diesel locomotives and steam locomotives, either in switching or in road passenger service, have not as yet been made available.

Factors Contributing to Increased Steam-Locomotive Horsepower

Many factors have contributed to the growing horsepower capacity of the steam locomotive. Notable among these are higher steam pressures and temperatures, better boiler proportions, and improvements in the entire chain of factors in the combustion sequence from the grates to the stack. During the past 13 years boiler pressures have increased from about 200 lb. per sq. in. to 275 or 300 lb. per sq. in. with fireboxes of staybolt construction and, in a few cases of water-tube fireboxes, still higher pressures have been employed. An increase from 200 to 275 lb. pressure, which may be considered typical, along with an increase of 100 to 150 deg. in steam temperature, has produced an increase in effective output for approximately the same input of nearly one-third. The capacity added by the feedwater heater was available in the best locomotives of the earlier period, and the only influence on the trend since that time is that due to its more nearly universal application on the new locomotives of today. The Type E superheater has been the agency by which the effective increase in steam temperature has taken place.

The increasing boiler pressures would scarcely have been obtainable within practical weight limits had there not been available alloy steels, the superior tensile strength of which could be utilized to withstand the higher stresses without increasing the weight. The nickel and silicon steels which were first employed about 12 years ago are now almost universally specified for the boiler shells of new locomotives and, to a considerable extent, for outside wrapper sheets as well.

The possibility of a reduction in boiler weights and perhaps also an increase in durability awaits the removal of the present restrictions against welding. Whether or not these restrictions can be removed with reasonable safety depends on the outcome of the experimental period of service with the Delaware & Hudson all-welded boiler. Whatever the outcome of this experiment may be, there seems little doubt but that ultimately a technique will be



Timken roller bearings in a one-piece housing

developed which will permit the practical attainment of the advantages of improved balance in the design and reduced weight which the application of welded construction offers.

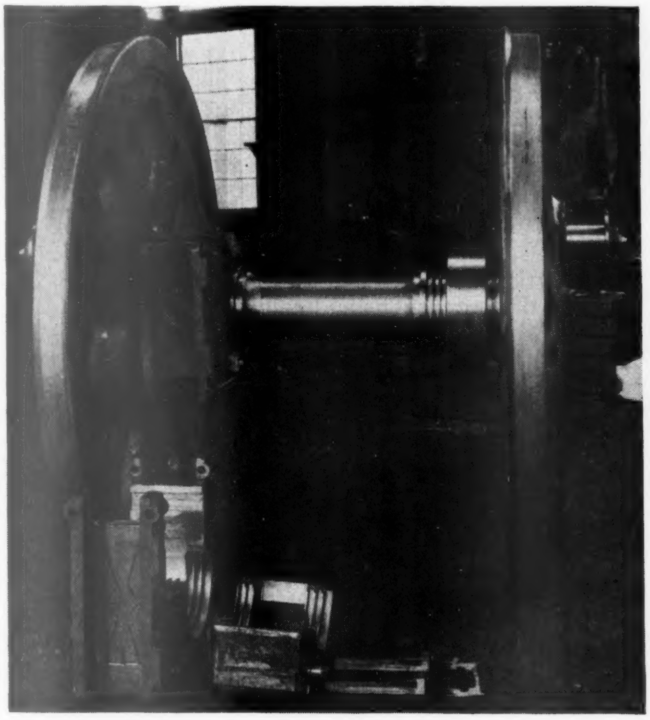
The general adoption of welding for inside firebox construction has, to a considerable extent, mitigated the difficulties experienced with earlier combustion-chamber fireboxes. It has further removed the restrictions on the inclusion of the combustion chamber and has made more widely available the better relationship of firebox volume to grate area which the combustion chamber provides. This is of significance in the matter of heating-surface distribution and also forms an important factor in the sequence bearing directly on combustion efficiency.

The application of Thermic syphons has also been gradually extended to include the combustion chamber as well as the firebox. Renewed interest in firebox circulation is becoming evident in the development of several new types of circulating mediums built into the firebox.

So far as possible within practicable limits increasing attention has also been paid in recent years to the direct relationship which should exist between gas areas through the boiler and grate area, and to front-end proportions. Attention has been directed to these important factors since the successful employment of the pin-hole grate for burning various grades of lignite completely upset long-established ideas with respect to air openings through

the grates. In the matter of grates, themselves, types are available by which improved distribution of air through the fire bed is effected. Grates are also available which permit the burning of bituminous slack with practically no ash-pan loss.

All of these factors combine to make the modern locomotive boiler a much more highly efficient steam generator and the locomotive a much more intensive producer of power than that of even 10 to 15 years ago. The largest horsepower output per driving axle of the locomotives tested at the St. Louis exposition in 1904 did not exceed 400 i. hp. About 10 years ago this had risen to about 1,000 i. hp. The tests of the new J-3 class 4-6-4 type passenger locomotives on the New York Central have shown an indicated horsepower per driving axle of almost 1,600. Designs are being considered at the present time contemplating a further substantial increase. These are all passenger locomotives. Although



SKF roller-bearing driving box

figures for freight locomotives in themselves are less impressive, the trend is of the same order.

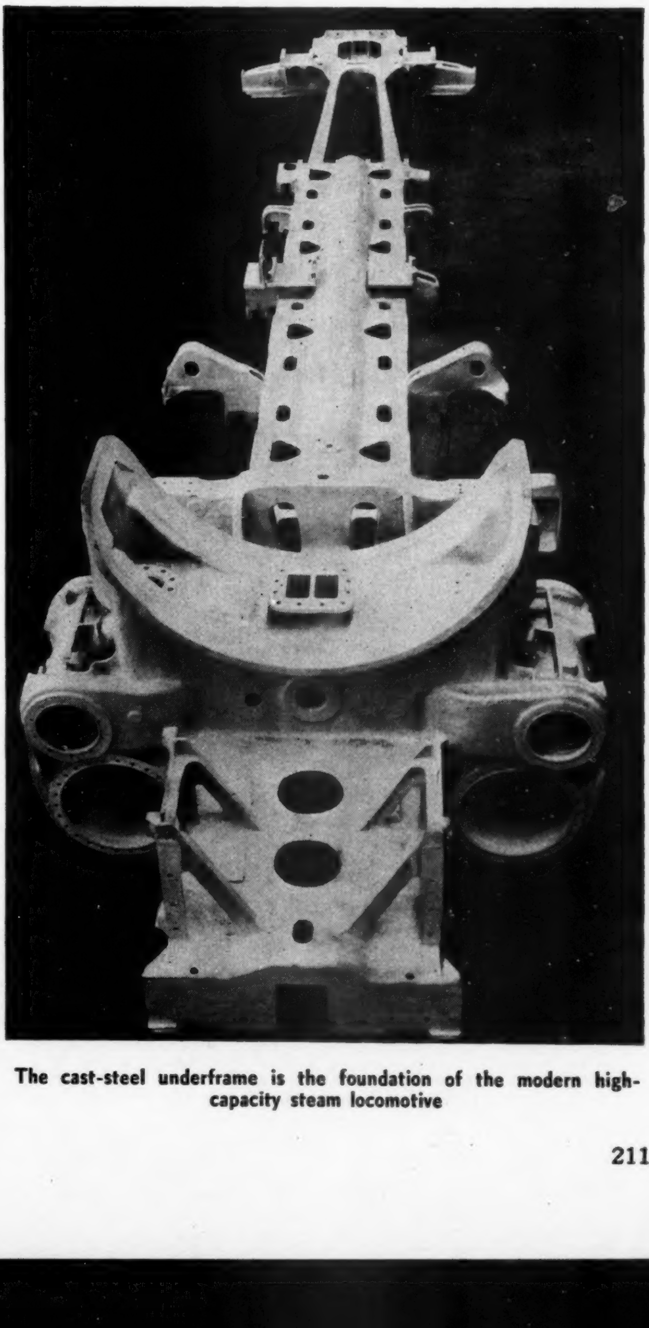
Better Balance and Increased Stamina

The higher horsepower for which the modern boiler has been able to supply steam has called for numerous improvements in the entire structure and mechanism of the locomotive. This begins with the cylinders and several segmental packings have been developed to keep down cylinder wear as well as to maintain a reasonable life of the packings, themselves.

In passenger locomotives the increasing concentration of horsepower output has been utilized to produce higher speeds. This has called for a complete reconsideration of reciprocating-part design and counterbalancing. Notable reductions have been effected in the weight of reciprocating parts in some of the recently built locomotives and greater care is being given to counterbalancing. For some years the employment of cross-balancing in the main wheels has been extending. In some recent designs for high speeds this has been extended to all of the wheels.

Not only has the increase in horsepower per axle been accompanied by increased loads on rods, pins and axles, but the increased speeds at which these horsepowers are developed has resulted in an even greater increase in the loads on running gear resulting from track reactions. Such forces tend to increase as the square of the velocity of the locomotive; hence, materially increasing the influence of this important factor in running-gear and frame design. The use of lateral-control devices has been extended. In at least one passenger-locomotive design the lateral is cushioned on the main, as well as on the front and back, drivers.

One of the outstanding qualities of the modern steam locomotive is its increasing mechanical reliability in spite of the increasing severity of working loads to which it is subjected by modern operating conditions. One of the factors producing this result is the bed casting. Despite the earlier fears as to the employment of cast metal in such large units and some early failures, the balanced distribution of metal characteristic of the later designs has removed the cause of most failures and repairs are readily made by welding when need arises. So great has been the increase in the stresses to which the foundation is subjected in modern locomotives of high horsepower capacity that frames on locomotives of otherwise modern design have been replaced by bed castings, in some cases within a few years of their original construction.



The cast-steel underframe is the foundation of the modern high-capacity steam locomotive

The new types of cast-steel driving wheels which are now rapidly replacing the old wheels with spokes of simple oval sections are a further development to meet the demands of the increasingly severe loads to which the locomotive running gear is subjected. They have also materially improved the possibilities of effecting adequate counterbalancing.

Close Tolerances and Controlled Flexibility

The roller bearing, particularly its application to driving boxes and, more recently, to crank pins, has inaugurated a revolution in ideas concerning the mechanics of the steam locomotive in America. Throughout the history of locomotive development in this country great weight has been given to the maintenance of the locomotive as a highly flexible vehicle. With the usual type of crown and sleeve bearings this flexibility has been maintained by employing large tolerances—extremely large tolerances if measured in terms of any other type of machine—in all running-gear bearings. A European visitor to America, observing this practice, once said: "Your locomotives are half worn out when they come out of the shop."

The very life of the roller bearing requires the maintenance of close tolerances in all fits relating to it to keep shocks below the danger point. The greater durability, not alone of the fits of the roller bearings themselves, but also of other fits which determine important alignments throughout the machine, which has been demonstrated on locomotives fitted with roller-bearing driving boxes and rods, is a revelation of a new era in locomotive reliability. Close tolerances in working fits and controlled movement where flexibility is essential promise much in reduced rates of wear and deterioration of the entire mechanism of the locomotive.

Along with the increased attention to working fits in the locomotive there has been a refinement in lubrication methods. The engineman's oil can has been almost completely replaced by the mechanical lubricator or the grease gun. Mechanical lubrication is being applied on new locomotives to guides, shoes and wedges, and hub liners. The automatic oil lubrication of engine-truck, trailer-truck and driving axles is also finding its way into the picture. The increasing application of pressure grease lubrication and of roller bearings to valve-motion pins, as well as the systematic lubrication of such parts as spring rigging and brake rigging, long quite generally neglected, is further evidence of the evolution of the steam locomotive into a fine mechanism.

Loose fingers, improved air distribution and reduced ash-pan losses characterize modern grates

Tender Trucks

The development of the tender to meet increasing coal and water capacities and the more severe problems of riding which greater speeds of both freight and passenger trains have caused has scarcely been less striking than the many improvements in the development of the locomotive, itself. The riding of tenders has constituted a frequently recurring problem for many years. The present trend in tender-truck design is approaching that of the passenger car, so far as the weight suspension is concerned. In fact, the tenders of at least one recently built order of locomotives are carried on Pullman trucks. The most recent development is the eight-wheel truck employed on the new locomotives delivered by Baldwin to the Atlantic Coast Line to carry tenders with a capacity of 27 tons of coal and 24,000 gallons of water, which are 48 ft. long.

The corrosion-resistant qualities of some of the low-alloy steels are being utilized in tank construction for their possible value in future reductions of maintenance.

The Economic Value of the Modern Steam Locomotive

This article has suggested the more important developments in the proportions and equipment of modern locomotives which account for their high economic value. There are two aspects of that value. What high capacity means has already been suggested. A familiar instance was the return of 38 per cent in the first year on the investment in some 20 modern high-capacity freight locomotives on the Lehigh Valley by which trains of 3,000 to 3,500 tons were handled over the road at from 10 to 15 per cent higher speeds than the 2,000 to 2,500-ton trains handled by the older power replaced in through main-line service. In addition to the saving in train-miles, higher fuel efficiency and reduced helper service were among the items contributing to the highly satisfactory financial result.

The other aspect of the economic value is the effect of the installation of modern locomotives on maintenance. In one case a group of modern freight and heavy passenger locomotives which constitute about 5 per cent of the locomotive ownership, the oldest of which are seven years of age, last year made approximately one quarter of the total locomotive mileage and approximately one half of the freight-locomotive mileage. These locomotives proved capable of making from 250,000 to 275,000 miles between shoppings, whereas other classes of older locomotives in freight service were able to stay out of the shops for Class 3 repairs for but little more than 100,000 miles.

In another case several classes of relatively new locomotives, constituting less than 30 per cent of the ownership, were responsible for over 50 per cent of the total road locomotive-miles in freight and passenger service. Last year, compared with 13 years ago, the cost of repairs per locomotive-mile showed a reduction of nearly 16 per cent in spite of increased cost. A part of this result may, no doubt, be attributed to the fact that the average miles between shoppings had about trebled within that period. Such results are due in part to the greater reliability and stamina of modern locomotives to meet modern operating conditions and partly to the tendency after the first two or three years of unit maintenance costs to increase steadily as the age of the locomotive increases.

Santa Fe streamliner built by Electro-Motive and Budd

Travel Patrons Being Won by

Style – Comfort – Speed

New equipment designed for maximum passenger appeal also proves helpful in making the general public "railroad conscious"

PASSENGER revenues of Class I railroads in the first three months of this year totaled $99,804,054, a decrease of $5,602,600 compared with $105,406,654 in the same period last year, but an increase of $3,283,872 compared with the corresponding 1936 period. The increases over earlier years are even more marked, being $14,368,311 over 1935; $19,787,907 over 1934; and $27,612,543 over 1933. The substantial improvement in passenger revenues since 1933 strongly indicates the important part modern passenger equipment has played in gaining and holding passenger traffic for the railroads.

Among various factors affecting the volume of railroad passenger traffic, the following may be listed in the approximate order of their importance: Safety, cost, styling, comfort and speed. Safety is so fundamental and generally associated with rail travel that it is more or less taken for granted. Next to safety, cost is probably the most influential single factor in mass passenger transportation. In other words, the best way to stimulate increased passenger traffic is to offer the service at rates which can be readily paid by a larger portion of the population. Styling, comfort and speed are vital features of any equipment designed to appeal to the modern traveling public, but the relative value of these three characteristics cannot be definitely and conclusively stated because, under certain circumstances, each is a primary consideration.

The importance of all of these elements of appeal in modern passenger equipment is amply demonstrated by results with the new lightweight streamline trains, 66 of which have been built and placed in service on 18 railroads throughout the country. The resultant increase in passenger traffic is difficult to determine accurately, but traffic managers say that more or less careful checks indicate the addition of roughly 20 per cent new business when these modern trains are installed. Evidently the styling feature first attracts prospective passengers and the comfort and speed features stimulate repeat business.

In addition to gaining and holding passenger traffic, as suggested in the opening paragraph, the new trains must be largely credited with a notable change in public sentiment favorable to the railroads. The trains attract thousands of sightseers daily on their initial advertised exhibition tours and, even after being in service many months, crowds gather at crossings to watch the more spectacular high-speed streamliners go by. It can hardly be questioned that a substantial part of the relatively high first cost of these trains may be charged to publicity since the trains have made thousands, if not millions, of people "railroad conscious" to an unusual degree and convinced them that modern railway managements are, in fact, alert, progressive and up-to-date.

Interior and Exterior Styling Receive Attention

Aside from new and rebuilt equipment installed within the last two or three years, the supply of railway

passenger cars is largely obsolete and inadequate with respect both to attracting passenger traffic and impressing the general public. Since the introduction of air-conditioning in 1930, a complete revolution has taken place, not only in the materials of construction and ideas with respect to weight in its relation to strength in passenger-car design, but also in the comfort of interior facilities and attractiveness of architectural and decorative treatment. Style factors, both interior and exterior, are beginning to receive and must continue to receive the serious attention of railway managements in attempting to attract patronage because the American people are becoming more and more style conscious and more and more fastidious with respect to personal surroundings.

Car exteriors have been styled to accentuate the idea of speed and an entirely new conception of comfort, cleanliness and attractiveness is apparent in car interiors. The change from suction to pressure ventilation introduced with air conditioning has removed the barriers which dirt imposed upon a free choice of color tones and the softening of interiors by the hanging of drapes. The design of interior architectural features and decorative treatment, formerly a function of the engineer, who selected his colors for their ability to make dirt as nearly invisible as possible, has passed to the trained artist with results in public reaction which were immediately favorable.

It may also be said that improved lighting has played an important part both as a comfort factor and as a decorative feature. In the new and refitted cars alike new ideas with respect to light distribution and light intensity are being carried out with a notable degree of success from the point of view of passenger appeal.

Only one caution need be observed and that is to exercise a reasonable degree of supervision over the consulting architect and expert interior decorator who, without some check, are almost sure to go further than necessary in covering up working parts with streamline shroudings and suggesting the use of delicate color schemes, upholstery fabrics, etc., which will not stand the rigors of railway service. In other words, a stiff price must be paid for modern styling, and good judgment is required to keep both the first cost and subsequent maintenance cost within reasonable limits.

Notable Improvements Effected in Riding Comfort

From the point of view of passenger comfort and convenience, modern passenger cars are so far superior to those of only a few years ago that there is no real comparison. Doubtless the greatest single improvement along this line is the development and general application of air conditioning which has taken place since 1930. According to a report just issued by the Association of American Railroads, Class I railroads and the Pullman Company had 10,417 air-conditioned passenger cars in service, as of April 1, 1938, an increase of 2,149 cars over the previous year. Of this year's total, 5,583 cars were owned and operated by the railroads and include coaches, dining cars and other types of passenger equipment, while the Pullman Company had 4,834 air-conditioned passenger cars in service, including sleeping cars, lounging cars, and other passenger equipment.

In general, four different types of air-conditioning equipment are installed, including electro-mechanical, direct-mechanical, ice and steam ejector, each of which has individual advantages in particular applications. Two problems, which may have been solved in advanced designs not yet generally adopted are the question of proper air distribution and the elimination of odors. An air-conditioned car is worse than useless for the purpose intended when cold drafts strike any part of the passenger's anatomy, or if, as sometimes happens, the recirculated air carries objectionable body and smoke odors.

No part of modern passenger-car design has received more intimate study than the trucks. While track conditions are a limiting factor in both the ridability of cars and the permissible speeds attained, real progress has been made in developing truck designs adopted to produce maximum ease of riding. Cylindrical-tread wheels are now used on many of the lighter trains; unsprung truck weight is minimized; special spring suspensions, sometimes incorporating rubber supporting pads and used in conjunction with hydraulic shock absorbers, effectively cushion rail shocks; truck-mounted brake cylinders with modern clasp brakes contribute to smoother brake applications.

Other mechanical improvements with a bearing on passenger comfort include the provision of tight-lock couplers and modern draft gears, sometimes of the rubber mat type, to minimize shocks in train handling; dia-

Interior appointments in one of the new Pullman Roomette cars

Modern lightweight alloy cast-steel truck equipped with roller bearings

The rotating reclining back seats are a feature of today's passenger equipment

Pleasing interior decoration and arrangement characterizes the Santa Fe's El Capitan

phragm and buffer applications designed with a judicious use of fibre bushings and wearing parts to reduce noise; and the provision of sealed windows and adequate thicknesses of modern insulating materials which have obvious advantages.

Car interiors are the "last word" as regards passenger comfort and convenience, and there is some question if the railroads have not gone too far in providing all of the appointments of the finest private club which necessarily add appreciably to the unit car cost and, therefore, reduce the number of modern cars which can be placed in service.

No defense is necessary for the comfort features, pure and simple, which are very important in keeping the public "sold" on rail transportation. Modern seating, washroom and lounge facilities are fundamental requisites. Rotating, reclining-back coach seats, as well as special lounge chairs, now largely designed with rubber cushions, represent a real contribution to riding comfort. Lunch room and dining car service have attained new standards of excellence, combined in many instances with relatively low cost. The improvements in and added variety of sleeping-car accommodations and facilities provided by the Pullman Company for the comfort and convenience of passengers are too extensive to be even listed in this article.

Increased Speeds Are Here to Stay

With maximum speeds in excess of 100 miles an hour, average speeds of 70 miles an hour for relatively short non-stop runs up to 100 miles, and average speeds of 65 miles an hour for runs up to 1,000 miles, it is apparent that the trend of railroad passenger train speeds is persistently upward. The public, in general, demands these speeds, and what the public wants it will get in this case, even though there is little knowledge or appreciation of what supertrain-speeds mean to the railroads in the way of increased operating and maintenance costs.

To the great credit of railroad managements, equipment designers, operating men and maintenance forces be it said that no major accident has happened to any of the high-speed passenger trains placed in service during the past three years and, in fact, so far as can be learned, no passenger has suffered a personal injury. Needless to say, all railroad men are profoundly thankful for this good fortune and fully determined to exercise every precaution in maintaining such a remarkable safety record intact.

Stainless steel dining car interior on the Burlington's Aristocrat

To keep the power demands of high speeds within economical limits light weight is essential and, since 1934 especially, there has been an intensive development in the application of aluminum alloys, stainless steel and low alloy, high-tensile steels to passenger-car construction. The light weight has been accompanied by streamlining which, if not of controlling importance, aerodynamically speaking, has been a potent style factor, as mentioned. As a practical matter, probably the bringing out of windows almost flush with the car sides, removal of projections and general smoothing of car exteriors has provided the greatest net reduction in air resistance. The shrouding of trucks has helped to a limited extent

and head-end lines have some bearing, particularly on short trains. On long trains, however, reduced air resistance due to so-called streamlining is a small factor compared to other elements of train resistance.

Fabricating methods used in building the new passenger cars represent a great improvement over former practice, the major difference, in the case of all steel cars, being the more extensive use of welding. Both manual and automatic arc welding and spot welding offer the modern car builder a fabricating tool which he has not been slow to use. Material has been saved, design simplified, rivet holes reduced in number or eliminated, and welded joints produced stronger than the parent metal.

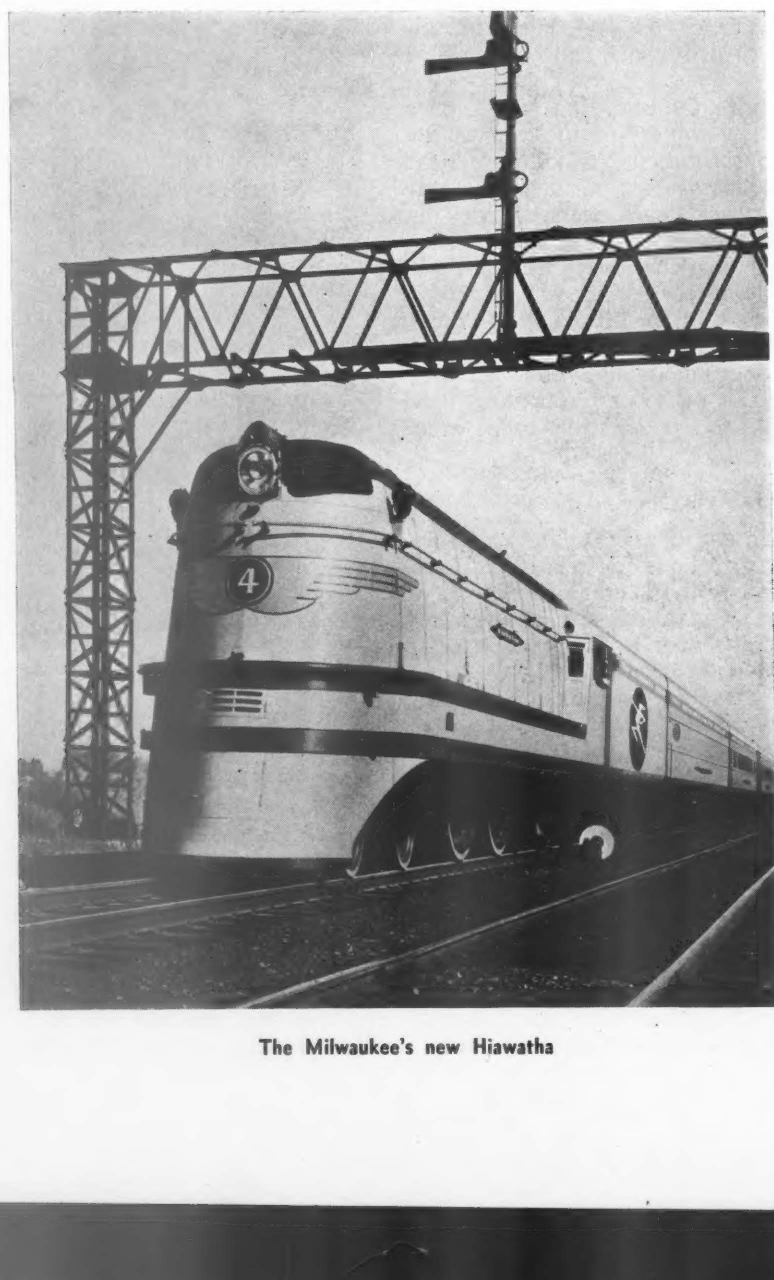
In general, it may be said that passenger-car weight can be reduced roughly one-third and at small increase in cost by the use of welded high-tensile low-alloy steel construction. If further weight saving is desired, a total reduction of 40 to 45 per cent from conventional car weights can be secured at a moderate increase in cost by the use of aluminum-alloy, or shot-welded stainless-steel construction.

The problem constantly confronting the car designer is how to avoid losing what he saves in reduced car-shell weight by what he puts in the cars and hangs on the trucks. In a recent light-weight welded-steel coach design, for example, the car shell weighed 25,868 lb.; the car body, 75,000 lb.; the two trucks, 37,960 lb.; and the total car, 112,980 lb. Part of this rather striking build-up in the total car weight was due to the use of relatively heavy floor construction, partitions and doors, a self-contained gas engine-generator set for air conditioning and trucks of somewhat heavier than average construction. Attention to all of these details, including car couplers, draft gears, truck castings and brake equipment made of high-tensile steel at some premium in cost is essential for maximum results in weight reduction.

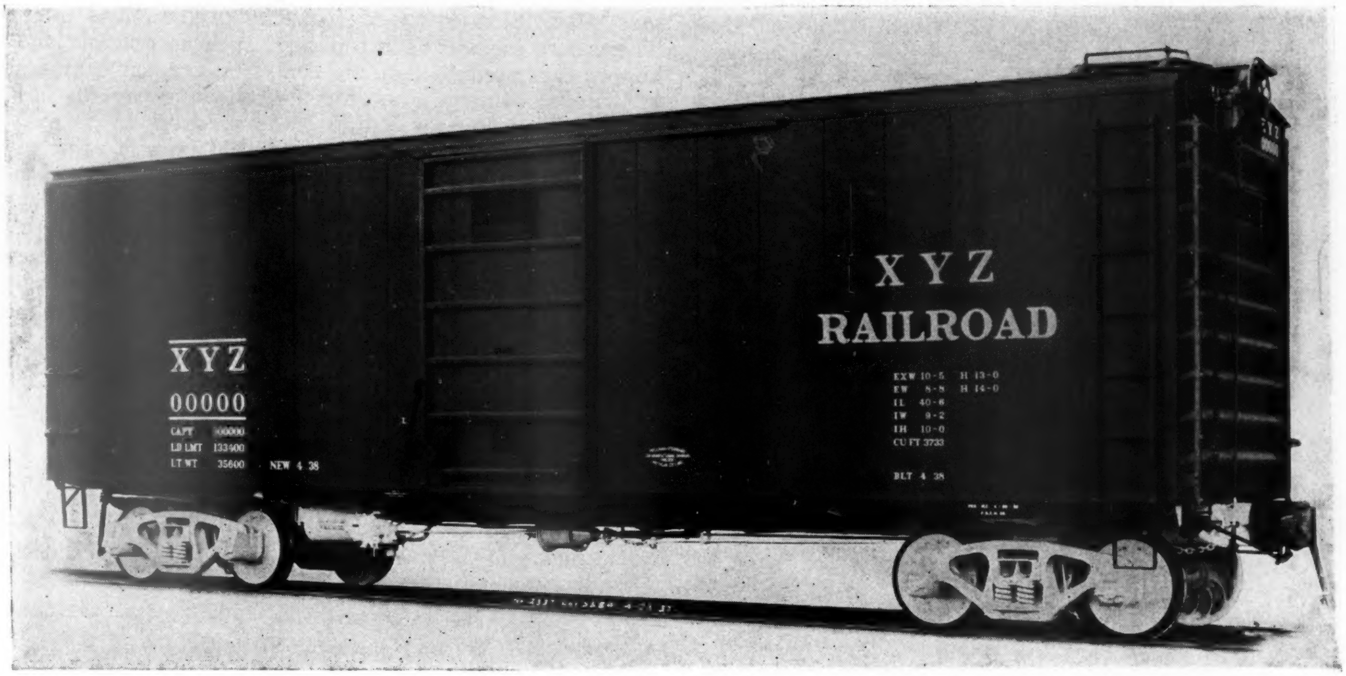
Two problems which still give some trouble in connection with ultra high-speed train operation are braking and wheel performance. In the interests of safety, the ductility of the steel truck wheels has been kept relatively low with resultant somewhat limited service life. High braking ratios and shoe pressures at high speeds also contribute to wheel wear. While the brake companies' high-speed brake equipments are designed to reduce shoe pressures and avoid wheels sliding to a stop, some trouble is still experienced in this particular and the indications are that, for this particular service, an auxiliary positive-acting device will have to be developed and applied to prevent wheel sliding.

The latest and most extensive installation of modern passenger equipment is that of the New York Central and the Pennsylvania, each of which is placing in service on June 15 complete new equipment for the Century and Broadway train operation between New York and Chicago. A total of 52 new Pullman cars is now being delivered to each of these roads.

Other programs of passenger equipment rehabilitation are under way, and the public reaction to modern cars and trains is so unmistakably favorable that the railroads are bound to continue the work so effectively begun.



The Milwaukee's new Hiawatha



An all-welded box car built by Pullman-Standard having a light weight of only 35,600 lb.

Less Weight—More Reliability—Feature

Modern Freight Cars

New designs utilize mostly high-tensile steels, in conjunction with more or less welded construction

SINCE 1935, over 16,000 lightweight freight cars have been built for service on American railroads incorporating for the most part low-alloy high-tensile steel construction and including such commonly used types as hopper cars, gondolas, refrigerators, box and automobile box cars. A feature of these cars has been the more or less extensive use of welding and the development of well-balanced designs adapted to give long and satisfactory service under the exacting conditions of modern high-speed operation. In addition to the steel cars, a limited number of special-service hopper cars and tank cars have been constructed of aluminum alloys, the resultant saving in weight, however, being essentially secondary to corrosion resistance in handling such commodities as high sulphur coals, acids, etc.

The possibilities in the way of weight reduction, utilizing modern materials and fabricating methods, are well illustrated in the table giving the general dimensions and weights of three typical 50-ton box cars, as compared to the latest A. A. R. standard design of 1937, which itself represents a saving of about 3,000 lb. over earlier designs in general use. Referring to the table, it will be noted that the A. A. R. car, embodying primarily riveted, carbon-steel construction, weighs 45,300 lb.; the Union Pacific 1937 car, built mostly of Cor-Ten steel by a combination of riveting and welding, weighs 39,000 lb.; the Mt. Vernon car, built in 1935 of Cor-Ten steel with riveted construction throughout, weighs 36,400 lb.; and the Pullman-Standard car of 1937, also built of Cor-Ten steel, but fabricated almost entirely by arc- and spot-welding, weighs 35,600 lb. These cars show a progressive increase in load limit and consequent ratio of load limit to maximum weight on rails from 73 to 79 per cent. Service tests, as well as impact tests, conducted by the A. A. R., Division of Equipment Research, have shown that even the lightest of these cars is essentially a sound structure.

How to Evaluate the Savings from Lightweight Cars

One of the most recent discussions of economies possible by the use of lightweight equipment, presented by O. Jabelmann, assistant to the president in charge of research, Union Pacific, before the Trans-Missouri-Kansas Shippers Board, at St. Louis, Mo., September 21, is so much to the point that it is quoted as follows:

"In taking up the economic possibilities of a lightweight freight car there are three principal items of possible savings:

"1—Saving in operating costs due to reduced tare weight.

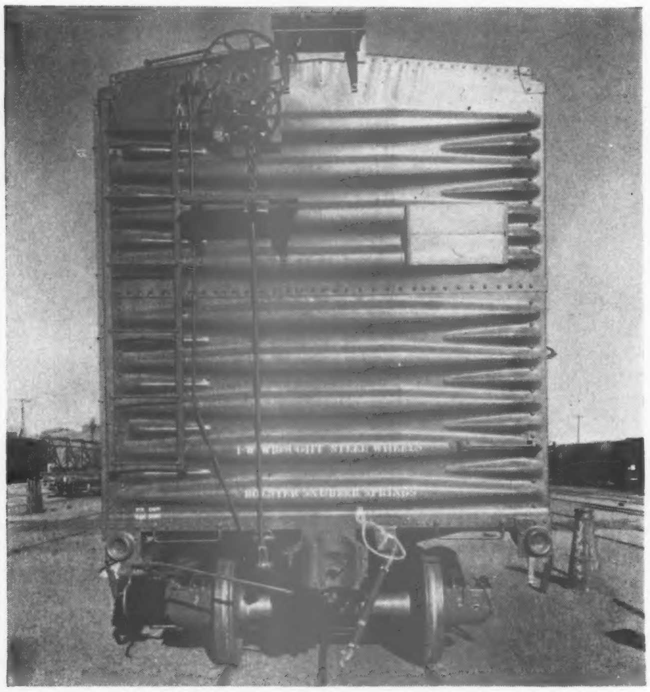
"2—Saving due to increased available capacity of car.

"3—Saving or loss in maintenance cost.

"The one item of loss in building the lightweight car is the increased initial cost as compared to the cost per unit of the conventional car, which can be readily estimated.

"Taking up the three possible savings:

"First, there can be figured in advance a definite saving in operating costs of the lighter weight car over a standard design due to reduced weight.



End view of one of the most recent designs of light weight box car

"Second, the saving due to the increased capacity of the car is possible only when the cars are loaded to their load limit. This condition occurs only a portion of the time in the case of box and automobile cars, and we would like to think of this as more of an available convenience than to itemize it as an actual saving in dollars and cents. This item is of greater importance in open-top cars which can most always be loaded to their load limit except when carrying light bulky material.

"Concerning the third item, maintenance cost of a lightweight alloy steel car, as compared to the standard type. We believe the only real way of determining this expense or savings would be to keep an accurate record of a number of lightweight cars over a period of several years, then average this cost and compare with the average expense of maintaining the standard car for the same period of time. Because of the lack of reliable information on this subject, we have assumed the cost of maintaining the two types of cars to be the same. We believe the possible longer life resulting from the use of the higher-strength steels offsets to some extent the greater cost of such materials when replacements are necessary. Any superior resistance to corrosion that high-strength steels possess may be offset, at least in part, by the fact that the structural shapes and sheets used in lightweight construction are thinner.

"A much discussed figure used in formulas on freight-car economy is the portion of total cost per ton-mile of moving freight-car rolling stock. We will assign the letter e to this variable. Regarding the value of e, there seems to be considerable difference of opinion.

"A value of \$.00170 per gross ton-mile is given on page 152 in the 1935 Report of Mechanical Advisory Committee to the Federal Coordinator of Transportation. This figure was obtained by taking the total direct freight-car operating expenses, including repairs to equipment from the selected accounts, for the year 1930, of five N. Y. C. lines, totaling \$139,758,884. This amount was divided by the gross ton-miles, exclusive of locomotives, of the same five lines, totaling 82,037,253,000. This value \$.0017 can be used only when figuring the saving made by weight reduction of cars that are most always loaded to axle capacity or their load limit. These cars include open top cars, such as gondola and hopper cars used for hauling coal, iron ore, sand, gravel and similar commodities. On the following page of this report is listed under Group 1 the accounts to be considered as operating expenses when obtaining a value of cost per gross ton-mile to be used in economy figures for cars not ordinarily loaded to their load limit, such as box, automobile and furniture cars. Using lightweight cars in this class of service would not necessarily reduce the number as compared to using conventional cars. When taking this into account the e figure obtained is reduced to \$.000846 per gross ton-mile.

"A figure of \$.001715 per gross ton-mile is computed from information given in an article by A. F. Stuebing, railway mechanical engineer, United States Steel Corporation, which appears on page 339 of the Railway Age of September 2, 1933. This is obtained by dividing the estimated total annual savings for a reduction of one ton in the weight of the car by the average annual freight car mileage. (\$17.97 ÷ 10475 = \$.001715).

"In a recent advertisement of the United States Steel Corporation it is stated, '\$18.00 is the carefully estimated average annual cost of hauling one ton of dead weight in freight car equipment.' This \$18.00 value, undoubtedly, corresponds to the \$17.97 mentioned in the 1933 article. Also, quote: 'In the 8,800 new lightweight freight cars, built of USS Cor-Ten in the last 2½ years, tare weight has been reduced 20 per cent and more. An average of four tons per car has been trimmed off, giving capacity for as much additional pay load. Revenue per car has been increased 6 per cent to 8 per cent with no increase in operating expense.'

"Let us now work out the economy of a particular lightweight box car, such as the Union Pacific 1937 design, as compared to a conventional box car weighing 45,100 lb. Assume that these cars are to be loaded to their load limit 90 per cent of the time. This will allow us to use the high value for e = \$.0017 per gross ton mile.

Comparative General Weights and Dimensions of Several Lightweight 50-Ton Box Cars of Recent Design

	New 1937 A. A. R. standard	U. P. 1937 H. T. steel design	Mt. Vernon 1935 design H. T. steel riveted	Pull. Std. 1937 design H. T. steel welded
Inside length, ft.—in.	40—6	40—6¼	40—6	40—6
Inside width, ft.—in.	9—2	9—2	8—9	9—2
Inside height at eaves, ft.—in.	10—0	10—½	9—4	10—½
Cubic capacity, cu. ft.	3,711	3,730	3,316	3,712
Light weight of car body, lb.	29,700	25,550	22,740	21,000
Light weight of trucks, lb.	15,600	13,450	13,660	14,600
Total light car weight, lb.	45,300	39,000	36,400	35,600
Load limit, lb.	123,700	130,000	132,600	133,400
Maximum weight on rails, lb.	169,000	169,000	169,000	169,000
Ratio $\frac{\text{load limit}}{\text{Max. wt. on rails}}$	.73	.77	.78	.79

Let W_1 = weight of conventional box car .... 45,100 lb.
W_2 = weight of U. P. 1937 lightweight car .... 39,000 lb.

then $W_1 - W_2$ gives a reduction in weight = ... 6,100 lb.

"Assuming an increase in cost of light-weight car over conventional car of \$300, then the cost per pound

$$\text{of weight saved} = \frac{300}{6{,}100} = \$.049, \text{ or 5 cents per lb.}$$

Let t_1 = Tax rate = ... 1 per cent
t_2 = Interest assumed = ... 3 per cent
t_3 = Depreciation rate (25 years) = ... 2.74 per cent

t_4 = Total fixed charge rate = ... 6.74 per cent
M = average annual mileage per box car on U. P. Lines = 10,000 miles
The operating expense saved per car per year =

$$M\,\frac{(W_1 - W_2)}{2{,}000}\,e = 10{,}000\,\frac{6{,}100}{2{,}000} \times .0017 = \$51.85$$

"From this amount each year the fixed charges are paid and the remainder, which is the net saving, may be invested at t_2 compound interest.

Fixed charges = t_4 (300) = .0674 × 300 = \$20.22
The net savings per car per year = S = \$51.85 — \$20.22 = \$31.63
The net savings per car in 25 years would be

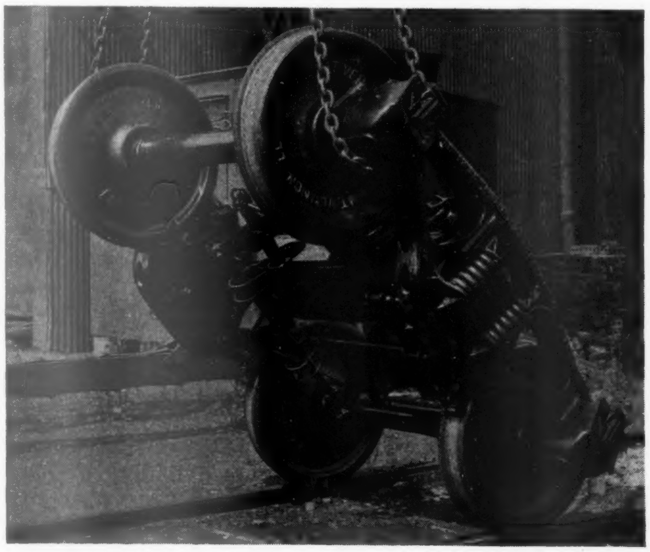
$$G = S \frac{(1+t_2)^n - 1}{t_2} = 31.63 \frac{(1+.03)^{25} - 1}{.03} = \$1,153.17$$

"By equaling the operating expense saving and the fixed charges we can determine the cost per pound that could be paid for weight saved, in other words, the cost that just balances the saving and fixed charges as follows:

$$M \frac{(e)}{2,000} = t_4 C, \text{ or } C = \frac{M\ (e)}{t_4 \times 2,000}$$

$$C = \frac{10,000 \times .0017}{.0674 \times 2,000} = .126 \text{ or } 12.6 \text{ cents per lb.}$$

"This figure is of value when considering the cost



Underside view of a modern lightweight spring plankless truck

paid per pound of weight saved for either the total car or break down detail parts of the car under consideration."

Increased Reliability in Freight Cars of Recent Design

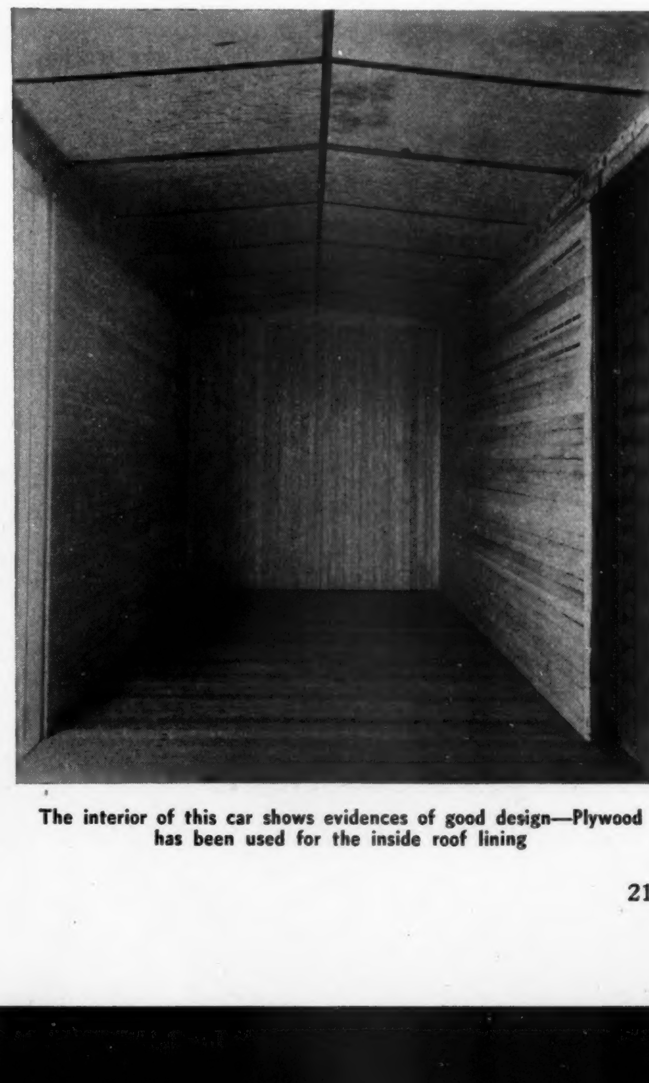
With the advances which have been made in materials and engineering design, the new lightweight freight cars represent a distinct improvement over earlier types, not only from the standpoint of weight saving but from that of increased reliability and freedom from service failures. This applies equally to the car bodies, which in general are designed to avoid peak stresses by the scientific application of extra material where needed, and also to the trucks which, by elimination of the spring planks, provision of lightweight wheels, high-tensile steel bolsters, side frames, etc., may be designed with a saving of roughly two tons in weight per car set and yet afford a simple, flexible and strong construction assuring years of service with little likelihood of failure.

While it must be admitted that the lightweight alloy-steel cars have been in service hardly long enough to give full information regarding maintenance costs, the indications are that more or less appreciable savings will be effected in this important particular. In general freight-car service, therefore, it is not unreasonable to suppose that the new high-tensile steels will show as much greater resistance to corrosion than copper steels, as the latter show when compared with plain carbon steels. The greater resistance to abrasion and physical abuse which is afforded by high-tensile steels is also favorable to a good maintenance showing.

Another factor of importance is the welded construction used more or less extensively in modern lightweight freight cars, especially when maximum weight saving is a prime consideration. Welding technique and equipment of both the manual and automatic type have been developed and improved to such an extent that unusually reliable results are being secured. A recent A. A. R. report for example, covering impact tests up to 13 miles an hour of a box car fabricated almost entirely by arc and spot welding, showed no defects, and a close inspection of 14,000 spot welds failed to disclose any indication of weakness or failure.

The welded seams and connections not only avoid overlapping construction, but make possible simplifications in design which effect substantial weight savings. In addition, there are no punched rivet holes to reduce the effective cross sectional area in tension and thus necessitate using slightly heavier sections. As regards the general efficiency of a welded joint or seam between two pieces of metal, modern welding practice permits developing the full strength of the original metal parts being joined, or more if necessary.

Still another important advantage of welding, in its bearing on car maintenance is the possibility of positively sealing exposed joints against water leakage and resultant accelerated corrosive action, especially when products such as high-sulphur coals are being hauled. This fact is well demonstrated in the case of five welded hopper cars built in 1931 for the Chicago Great Western by the Pullman-Standard Car Manufacturing Company, these cars having been remarkably free from deterioration or the necessity of repairs during a period of six years in which they have been assigned largely to the



The interior of this car shows evidences of good design—Plywood has been used for the inside roof lining

hauling of Southern Illinois coals with a relatively high sulphur content.

Cars Must Be Designed and Equipped for High-Speed Operation

The statement that average freight-train speeds increased from 11.9 miles an hour in 1926 to 16.1 miles an hour in 1937 does not give a real picture of what is happening. The fact is that many manifest freight trains are being operated on practically passenger train schedules, and speeds of 50 or 60 miles an hour are by no means uncommon. This means that modern well-maintained draft gears must be installed to cushion shocks in train handling and, even more important, adequate brake equipment provided to permit stopping long heavy trains safely from high speeds within the required distances. The flexibility, uniformity and reliability of brake applications with the new Type AB freight brake make its general application highly desirable and, if the present tendency towards higher train speeds, in conjunction with higher ratios of load limit to light car weight, is maintained, the empty-and-load brake feature will become a necessity. Savings in car maintenance as a result of smoother brake action are offset to a certain extent by increased cost in repairing the somewhat more complicated AB brake equipment, but there will be an important net saving in lading damage and attendant claims.

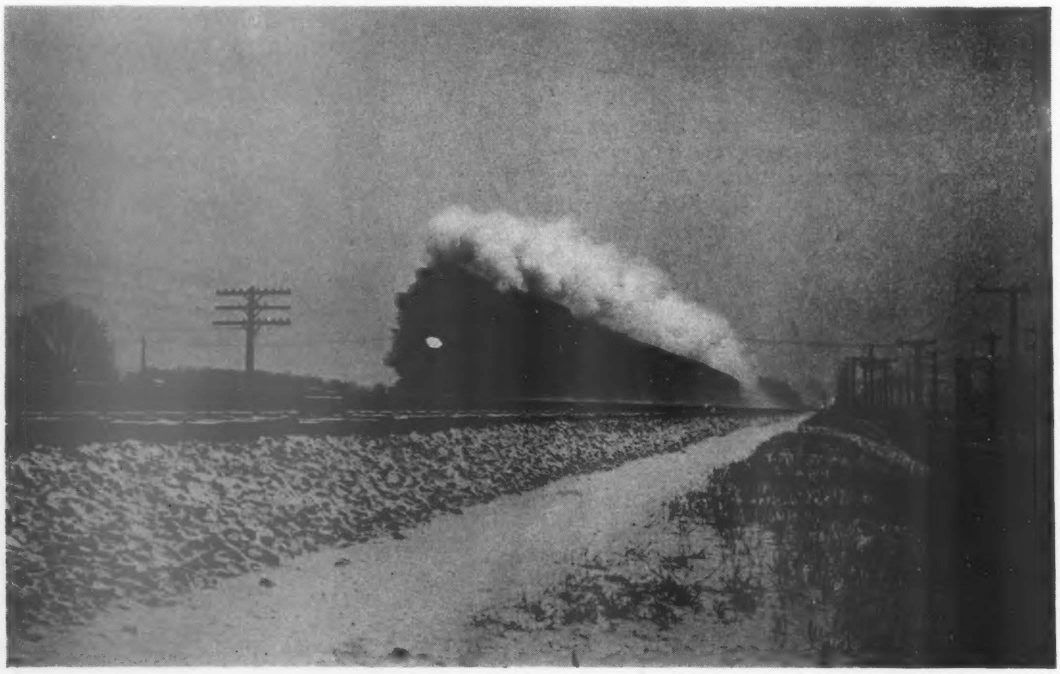
Next to adequate brakes in contributing to safe operation and the reduction of damage claims is the freight car truck which must provide not only maximum reliability and freedom from maintenance difficulties, but easy riding qualities far in excess of those required when freight train speeds seldom exceeded 30 to 35 miles an hour. Concentric wheels, better spring maintenance and modern truck stabilizing and spring snubbing devices seem to be essential requirements for all cars used in the shipment of commodities which may be damaged by excessive vertical oscillation at critical speeds above those formerly attained.

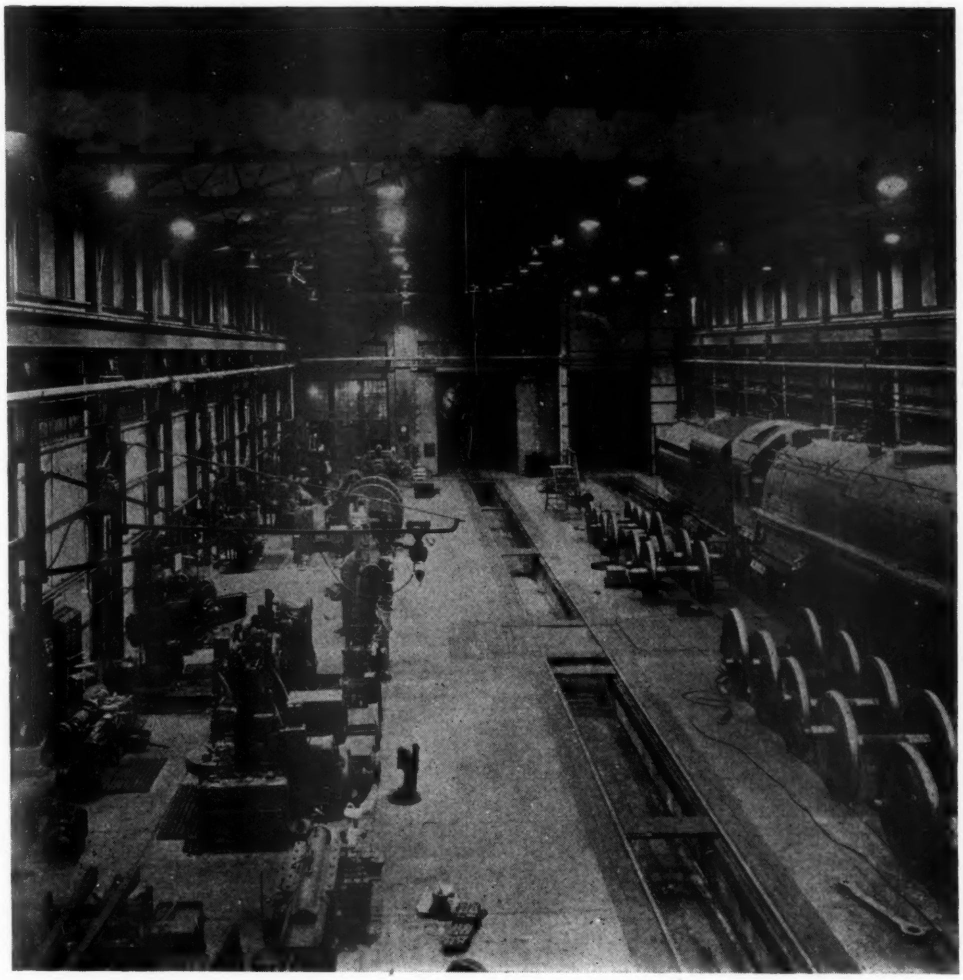
The foundation of the modern freight-car truck is, of course, the cast-steel bolster, and side frame with integral journal boxes, which represent years of experience and development largely on the part of the manufacturers who now furnish both side frames and bolster castings of adequate strength, reliability and wear resistance, and entailing only a small fraction of the expense required in maintaining earlier designs. Comparatively recent improvements in truck design have included elimination of the more or less troublesome spring plank and the provision of enough flexibility between bolsters and side frames so that trucks can negotiate curves more easily at high speeds, with less thrust and wear on the wheel flanges, truck frames, journal boxes and associated parts. Like other truck parts, lightweight brake beams are now available, made of high-tensile steel and meeting all A. A. R. strength requirements. The necessity of providing reliable brake-beam suspension, and safety hangers to support the brake rigging in the event that any part fails needs hardly be stressed, in view of potential hazards, particularly in high-speed operation.

Modern draft gears, hand brakes, door-operating mechanism and other important details are destined to play their part in the freight car of the future. In box cars, the metal roofs must not only serve as part of the car structure to tie the sides and ends together, but be waterproof and treated on the inside to overcome condensation difficulties. A number of railroads have experimented with various insulating compounds sprayed on the interior roof sheets, and others have applied complete inside roof linings of plywood, or other materials, in attempts to prevent condensation losses. In refrigerator cars, insulation materials and their application constitute a major problem.

The manufacturers of all these various materials and devices have worked with the car builders and the railroads, in developing designs of freight cars which are efficient, revenue-earning units vastly superior to earlier types. In view of potential operating economies, improved service, reduced damage claims and lessened maintenance expense, the sooner the present large inventory of obsolete, worn-out freight cars is replaced by new and modern equipment the better it will be for the railroads.

* * *





Factors Which Influence

The Cost of Maintenance

Modern locomotive design and improved repair facilities and methods have enabled the roads to stabilize the unit cost of maintenance while motive-power capacity increases

In the process of accumulating the information from which to prepare this article the writer called upon a mechanical officer who is well known for the soundness of his views on policies affecting locomotive repairs and asked him these questions: "What have been the most important factors in locomotive design which have contributed to a reduction in the cost of locomotive repairs?" and "What changes in shop facilities or methods have contributed to a reduction in the cost of locomotive repairs?" His answer to these questions came immediately in the form of another question: "Upon what do you base the assumption that there *has* been a reduction in the cost of locomotive repairs?" The ensuing discussion merely served to emphasize again the fact that in matters relating to railroad operation it is not always safe to assume that a condition relating to the country as a whole is equally a fact when applied to one particular road and, conversely that which may be true concerning operation on one road does not always apply to the country as a whole.

The assumption upon which the statement was made was based upon the fact that the cost of repairs per locomotive mile in freight service dropped 25 per cent during the period from 1924 to 1936 (the latest year for which complete figures are available) for the Class I roads. It would seem that one might assume that the cost of locomotive repairs has undergone a similar reduction on all well-operated roads, whereas it will be found that on some roads this figure has remained about the same or has resulted in a slight increase. It is of incidental interest to note that the cost of locomotive repairs per locomotive mile in freight service has increased 13 per cent since 1932, the year in which the "per-mile" figure was the lowest.

There is a difference of opinion among mechanical men as to the value of the per-mile figure, its opponents contending that it is not a true indicator because of the fact that it ignores the size of the locomotive with the

attendant increase in the hauling capacity. It is entirely outside the scope of this article to discuss the value of the figure except as an indicator of a trend. As such it indicates that the unit cost of locomotive repairs in freight service has been consistently reduced over a period of years to the low point of 1932 with the single exception of 1923 in which the effects of deferred maintenance during the shop men's strike were being paid for. Since 1932 the unit cost has been consistently increased until now it stands at 13 per cent above 1932 and 25 per cent below 1924.

During the 8 years from 1924 to 1932 the expenditures for freight locomotive repairs declined from 321 to 128 million dollars, increasing by 1936 to 193 million dollars. (Freight locomotive repair cost has remained consistently at an average of 70 per cent of all steam locomotive repairs.) During the same period freight locomotive mileage dropped from 998 to 607 million and up again to 804 million by 1936. Gross ton-miles, on the other hand, increased from 954 to 1,141 million from 1924 to 1929; decreased to 657 million in 1932 and came back to 896 million in 1936. Train loading increased from 1,588 gross tons in 1924 to 1,870 in 1930 (1929 was 1,866); decreased to 1,682 in 1932 and rose again to 1,860 in 1936. The average train load of 1,902 gross tons in 1937 is the highest during the entire period.

These statistics might serve only to confuse the discussion were they not valuable in providing the background for the statement that, taking the Class I roads as a whole, the cost of locomotive repairs in freight service has decreased substantially on the locomotive-mile basis while the transportation tool for which the money has been spent is doing a bigger job today than it has ever done before.

It is undoubtedly true that over the entire period there has been a substantial improvement which has been reflected in the unit cost figure but it is equally true, especially since 1929, that a considerable part of the reduction in unit cost has been the result of deferred maintenance. Then too, over that same period the unit cost basis has had the advantage of a condition in the railroad industry in which the gradually diminishing volume of demand for motive power has made it possible to utilize locomotive mileage which never had to be restored. Were statistics available to develop such a unit the "cost of locomotive repairs per mile restored" might result in an entirely different picture.

An analysis of general statistics falls far short of developing data to prove what is known to be a fact; namely, that the average locomotive of today will run from three to four times as many miles between shoppings for general repairs as the locomotive of 1924 would and does haul about 25 per cent more tonnage per train at a higher speed than did its predecessor of 14 years ago. That, in simple terms, is a statement of the job it has done, and the fact that it has accomplished such a job at a unit repair cost no greater than, and probably less than, the cost of 1924 is sufficient justification for its continued existence.

How has this job been accomplished? The answer lies in two important factors: (1.) Improvement in design and in operation, and (2) improvement in the character of facilities and the methods used in locomotive repair work.

The Influence of Design

One of the distinct advantages of the locomotive of today is its ability to stay away from the repair shop for much longer periods than its predecessor of 10 to 15 years ago. Many changes in design have taken place which have contributed materially to a situation wherein locomotives may have performed assigned mileages ranging from 100,000 to 200,000 miles of road service between shoppings instead of from 30,000 to 75,000 miles. The advantages of many of the materials and devices such as alloy-steel rods, axles and motion parts, cast-steel beds and roller bearings, are too well known to warrant detailed repetition here. In boilers and fireboxes, alloy-steel sheets, and welding have played an important part while water treatment alone has gradually extended the required time for flue renewals. In addition the introduction of force-feed oil lubrication and pressure grease lubrication has served to reduce wear on parts to such an extent that, in one case, a locomotive stayed out of the general repair shop for four years.

Improvements in Repair Facilities and Methods

Of outstanding importance in maintenance work during the past 15 years have been two major changes: The development of preventative maintenance on locomotives, and the gradual concentration of repair work at shops and terminals where the facilities are the most modern. The idea of repairing locomotives for a predetermined term of service came in with the introduction of longer locomotive runs. Operating conditions demanded the latter in the interest of economy and it was found that a much higher standard of maintenance was required in order to assure reliable service over longer distances. Because locomotives are required to be inspected regularly, advantage is taken of washout periods to perform such minor repair work as will keep motive power in service without interruption. This results in the ability to perform greater service without attendant and proportionate increases in repair costs.

When it is considered that the modern locomotive—whether it be new power or modernized power—is a much more complicated machine than one of several years ago it is really remarkable that it can be maintained within the cost figures that are being established today. Obviously the cost of a general-repair job on modern power is greater than it used to be but the greater service rendered holds down the cost per unit of service rendered.

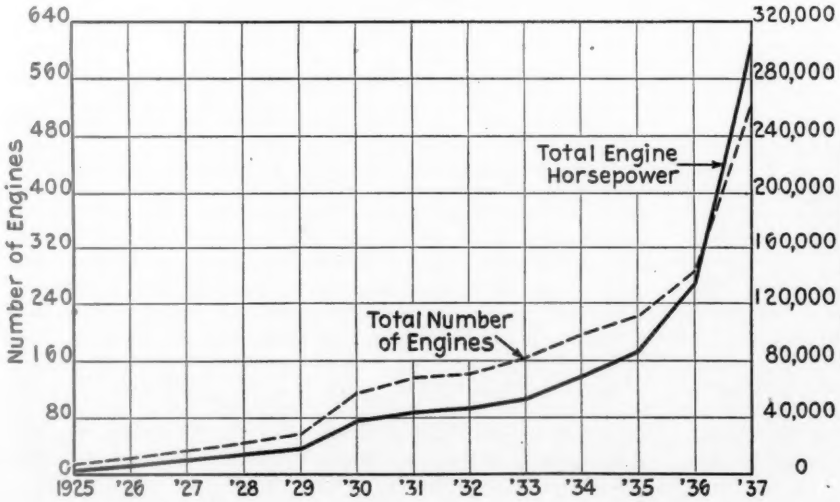
No small part of the ability to do this has been due to radical changes in the methods of shop operation as well as in the tools with which the job is done. The changes that have taken place in the system of shop functioning as well as the idea which has prompted the replacement of many obsolete units in the shops have been made to assure production in volume at low unit cost. Unfortunately, business conditions have not provided a sufficient volume of repair work to enable the roads to determine what may be the maximum savings effected as a result of expenditures for new facilities, but the actual savings in numerous cases have been enough to indicate the course to be pursued in the future.

Several facts stand out very clearly. We should not be deceived by what may appear to be a satisfactory reduction in the unit cost of maintenance. It is perfectly obvious that much of this reduction since 1929 has been the result of deferred maintenance. The restoration of a balance in locomotive mileage after a period of curtailed expenditures is usually done at an increase in unit cost and there is always the danger, in our zeal to effect economies, of being in the embarrassing position of the man who burned his furniture to heat the house. He may run out of furniture before the winter is over. The margin between revenues and expenses is narrowing all the time and with this condition the absolute necessity of reducing expenses to stave off bankruptcy is becoming more acute. It appears that the day is here when railroad men can no longer ignore the possibilities of modern power and locomotive repair facilities as a means of effecting such a reduction.

Diesel-Electric Locomotives in the United States and Canada

Railroad	No. of units	Service	Name of builder of— Locomotive	Engine	Elec. equip.	Engines— No.	hp. each	Total weight, lb.	Date in service
A. T. & S. F.	2	Switch.	Alco	Alco	West.	1	600	200,000	1937
	1	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	4	900	500,000	1937
	1	Switch.	Baldwin	Baldwin	Allis-Chalmers	1	600	200,000	1937
	3	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	3	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937
	2	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	4	900	500,000	1938
	6	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	2	900	250,000	1938
B. & O.	4	Pass.	E. M. C.	Gen. Motors	West.	4	900	500,000	1937
	1	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
B. & L. E.	1	Switch.	Baldwin	West.	West.	2	265	140,000	1936
Birmingham Southern	6	Switch.	Alco	Alco	West.	1	900	230,000	1937
	5	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937
Boston & Maine	1	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1938
(Portland Terminal	1	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1938
Canadian Pacific	1	Switch.	Nat'l Steel Car	Harland & Wolff	Laurence Scott Co.	1	600	200,000	1937
Canton R. R.	1	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
Chicago & Eastern Illinois	1	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1938
	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1938
Chicago & Illinois Western	1	Switch.	Alco	Alco	West.	1	600	200,000	1935
Chicago, Burlington & Quincy	6	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	900	250,000	1937
Chicago, Rock Island & Pacific	6	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	1	1,200	210,000	1937
	18	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937-8
	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	900	250,000	1938
East Erie Commercial	1	Switch.	Gen. Elec.	Cooper-Bessemer	Gen. Elec.	1	300	114,000	1935
	1	Switch.	Gen. Elec.	Cooper-Bessemer	Gen. Elec.	1	300	114,000	1937
	1	Switch.	Gen. Elec.	Waukesha	Gen. Elec.	2	165	112,000	1935
E. J. & E.	9	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	900	250,000	1937
	1	Switch.	Alco	Alco	Gen. Elec.	1	900	230,000	1937
	1	Switch.	Alco	Alco	West.	1	600	200,000	1937
Ft. W. & D. C.	1	Switch.	Cummins	Cummins	Gen. Elec.	2	500	180,000	1936
Great Northern	1	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	900	250,000	1937
	1	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937
Lehigh Valley	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	4	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	900	250,000	1937
Massena Term. Ry.	1	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1937
Missouri Pacific	4	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	2	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937
Monongahela Connecting	1	Switch.	Gen. Elec.	Cooper-Bessemer	Gen. Elec.	2	300	164,000	1936
	1	Switch.	Gen. Elec.	Cooper-Bessemer	Gen. Elec.	2	500	240,000	1937
	2	Switch.	Gen. Elec.	Cooper-Bessemer	Gen. Elec.	2	300	160,000	1937
New Orleans Public Belt	3	Switch.	Baldwin	Baldwin	West.	1	900	240,000	1937
N. Y. N. H. & H.	10	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1938
Northampton & Bath	1	Switch.	Bethlehem	West.	West.	2	800	266,000	1937
Patapsco & Back Rivers	5	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	5	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1937
	2	Switch.	Alco	Alco	West.	1	600	200,000	1937
Pennsylvania	1	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
Peoria Terminal	1	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
Phila., Beth. & N. E.	4	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	4	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937
Reading	6	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1937
	2	Switch.	Alco	Alco	Gen. Elec.	1	900	230,000	1937
River Terminal	2	Switch.	E. M. C.	Gen. Motors	Gen. Elec.	1	600	200,000	1936
South Buffalo Ry.	1	Switch.	Alco	Alco	Gen. Elec.	1	900	212,000	1937
	8	Switch.	Alco	Alco	Gen. Elec.	1	600	200,000	1937
Union Pacific	1	Pass.	Pull.-Std.	Gen. Motors	Gen. Elec.	1	1,200	200,000	1936
	1	Pass.	E. M. C.	Gen. Motors	West.	6	900	1,020,000	1937
	1	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	6	900	1,020,000	1937
	1	Pass.	E. M. C.	Gen. Motors	Gen. Elec.	4	900	......	1937
Warrior River Term.	1	Switch	Alco	Alco	West.	1	900	230,000	1938
Youngstown Northern	2	Switch.	Alco	Alco	Gen. Elec.	1	900	230,000	1937
	2	Switch.	E. M. C.	Gen. Motors	West.	1	900	250,000	1937

* This list supplements one published in the February, 1937, *Railway Mechanical Engineer* and includes units placed in service or ordered between January 1, 1937, and March 1, 1938.



The chart to the left shows the total number of Diesel engines and the total Diesel engine horsepower installed in motive power units (locomotives and rail cars) in the United States and Canada. The 1937 total includes units placed in service up to March 1, 1938. Of special interest is the fact that the total horsepower installed in the 14 months from January 1, 1937, exceeds the total for the previous 12 years

Gleanings *from the* Editor's Mail

(The Apprentices Speak)

The mails bring many interesting and pertinent comments to the Editor's desk during the course of a month. Here are a few that have strayed in during recent weeks.

Special Problems for "Specials"

Many special apprentices have stated that they wished they had some responsible problem to work on just to keep in shape with their past college work. The railroads that hire these special apprentices could help themselves and the special apprentice by giving him some problem to analyze and work on, which the railroad or the shop is working on, together with his regular training course. This will let him feel that he is doing something for his company and at the same time build up his confidence, which the railroads do need in their men.

Work Hard at the Job

Truly, it is easy to look on the dark side these days of "recession." If a fellow is going to get ahead he must work—by this I mean, study and get all the outside information of his trade he can obtain. Before a young man learns the machinist trade he should have his mind made up as to whether or not he will like this trade for his life's work. I am taking a correspondence course and feel that every apprentice should. Last, but not least, I think an apprentice should take magazines such as the *Railway Mechanical Engineer*. It has proved very helpful to me and I think very highly of it. I think the railroads should encourage this outside help more than they do.

Written Instructions in the Shop

During the time spent by a special apprentice in various shops much effort is made to secure written instructions on the work, and it has been found that in the majority of cases these instructions are scarce and cannot be taken out. These instructions should be given to each and every apprentice and special apprentice upon entrance to each shop, and be returned to the shop when he leaves, so that he may study while working on the equipment. The foreman and high officials should meet at their convenience periodically to question and be questioned by these apprentices. The better the relations established between the men in training and the railroads, the stronger the bond will be in securing a reliable and substantial foundation for the future.

Technically Trained Men Needed

A group of technical men having special training and ability to co-ordinate the efforts of the mechanical, operating and maintenance departments could be inestimably valuable. Unfortunately for the well-being of the railroads, it is impossible for some men to see from their own rut the problems facing other departments. These specially trained men would be better equipped to analyze possible economies as a whole, rather than with the viewpoint of but one department. While I fully recognize the inexperience of the technical graduate, his suggestions are usually worthy at least of examination, because he has not only been trained to examine facts thoroughly, but has the advantage of the newcomer's perception Such men could be very well developed into executive material.

A Special Apprentice Comments

What is needed most is a carefully worked out plan of instruction for apprentices and a person of experience and foresight to have direct supervision over them, and to see that they are given a varied training and not left in one department for the duration of their course of training. As it is now, the majority of apprentices are left to shift for themselves in shops or enginehouses, or else they are assigned to special duty and never get a chance at other work. Consequently, when positions are open the lack of experience generally prevents the apprentice from filling these vacancies.

Apprentices Need Training in Theory

Concerning apprenticeship training, I think that the railroads should hold classroom periods two days a week for one hour each, to give the apprentice the theoretical as well as the practical background. One reason I am a subscriber to the *Railway Mechanical Engineer* is because I desire the theories found within this fine publication. I have studied from various books and pamphlets, seeking further knowledge. The past three years I have been and still am attending night school. I have studied courses in heating, ventilation and air conditioning; production methods and tool engineering, and machine design. These have all been very helpful to me.

Square Pegs in Round Holes

The boy (apprentice), more often than not, regards his apprenticeship as merely a job until he can get something better. No attempt is made to fit him to a job, or to improve his ability. Potential boilermakers may be found in any brass shop, and good welders may be going to waste in the machine shop. Usually they are placed where they are needed today, without regard for where they will be needed tomorrow. A great deal more can be said on both sides, but today, the only way to morally justify the low rates paid to apprentice boys is to give them training that will be valuable even though they can expect nothing more than an indefinite lay-off when their period of training is over. I believe the fundamental solution lies in the development of personnel departments with ability and authority to co-ordinate apprentice programs with the needs of the railroad, and to create better personnel relations within the industry.

Railroads Should Protect Apprentices

If the railroads don't train apprentices and then when they are in need of mechanics they get men trained on the outside, they are decreasing efficiency and increasing their maintenance bill. How? Because the outside man is coming into a strange plant and doesn't understand the work like the man that has been trained in the railroad shops. Therefore, when times like the present arrive and the railroad operates a skeleton crew, there should be a rather large group of apprentices working, in order that they may finish their time. If an apprentice must serve four years, but it takes him eight, due to shut-downs, then he becomes discouraged, loses interest in his work and finally leaves. My first interest is the railroad and I think it is my future and that I can accomplish something on a railroad; but when I have been furloughed for seven months without any sign of going back in the near future, I just can't help but stop, look and listen for a moment.

THE READER'S PAGE

Smokeless Operation of Steam Locomotives

TO THE EDITOR:

The problem of securing the proper combustion of coal, thereby diminishing the smoke nuisance and other well-known troubles, has confronted the operators of locomotive engines since the earliest days of railroading. There is still extant a manuscript containing a legal opinion dated August 9, 1814, relating to the locomotives then in use on the Wylam Colliery Railway in England. This opinion asserts that "in the operation a little noise and Smoak is certainly made which A considers a nuisance." How often since that day has this same complaint been echoed!

In the April number of the *Railway Mechanical Engineer,* there is an abstract of a report by William G. Christy, in which he intimates that modern American locomotives suffer from poor combustion, or incomplete combustion. Mr. Christy advocates the introduction of air over the fire in some manner, and suggests that it may be necessary to redesign the firebox in order to attain this end. The admission of a secondary supply of air above the fuel-bed is unquestionably sound in principle, and the practical application of the idea has received a great amount of attention on American railroads. Failure to evolve any generally accepted standard practice may be charged very largely to the fact that the expense and difficulty of maintaining the most efficient arrangements, which were too often the most complicated ones, were generally more than sufficient to balance any gain from improved combustion.

In the days of hand-firing, firemen were frequently given detailed instructions for minimizing the emission of smoke by proper manipulation of the firedoor. This practice can be a source of trouble, because of incomplete mixture of the incoming air with the firebox gases sometimes resulting in quantities of comparatively cold air striking the tube-sheet with anything but a beneficial effect. Combustion tubes similar to those described in the *Railway Mechanical Engineer* for February, 1936, page 48, have been applied in large numbers on various railroads, ever since D. K. Clark perfected this ancient system of induced air jets in 1858. Several Class I railroads have used them on most of their larger engines for many years. The experience of these railroads should indicate the value of such an appliance. It seems only reasonable to conclude that the tubes would have been abandoned long ago if they had not served their purpose.

The well-known Gaines firebox and combustion chamber, with its brick wall containing passages through which heated air is admitted above the fire, should be familiar to most readers. This was perhaps the most successful of all the more ambitious attempts to secure a continuous influx of fresh air over the fuel-bed. Its use was widespread, but recent applications have been mostly confined to large articulated locomotives. The feeling of many American engineers toward such devices as this was once expressed by an eminent authority in the following words: "It is doubtful whether the question of the value of various forms of the brick arch for admitting hot air, etc., will ever be satisfactorily settled in any one way to the community at large."

In contrast to the apparent lack of agreement among American engineers regarding those adjuncts of the locomotive firebox which tend to promote smokeless combustion, little divergence of opinion exists in Great Britain. There, the question of burning bituminous coal with a minimum of smoke was definitely settled by the work of Charles Markham on the Midland Railway between 1856 and 1860. Air-tubes through the firebox front and sides, solid and perforated brick arches, combustion chambers of varying degrees of complexity, etc., were all tried and discarded. (It is only in very recent years that the combustion chamber has reappeared in the boilers of 4-6-2 and 2-8-2 type engines, as a means of keeping the tubes to a moderate length.) The solution finally arrived at embodied a long, solid brick arch, and provided for the continuous admission of a supplementary air supply through the firedoor. A deflector plate was attached to the inside of the fire-hole to direct this air downward toward the surface of the fuel-bed.

In Germany, the evolution of smoke-consuming apparatus began very early and covered a long period. Simple and complicated devices of almost every imaginable variety were tried, culminating in the present standard Marcotty firedoor, which has now been reduced to a very simple form, the steam jets and automatic blower formerly incorporated having been abandoned as costly and unnecessary refinements. With the Marcotty arrangement, air is automatically drawn in through specially designed passages beside the firedoor and discharged above the fire, whenever the firebox vacuum exceeds a predetermined figure. It may be worthy of investigation by those who aim to improve the process of combustion in American locomotive fireboxes.

W. T. H.

A Suggestion to Eliminate Piston-Rod Failures

TO THE EDITOR:

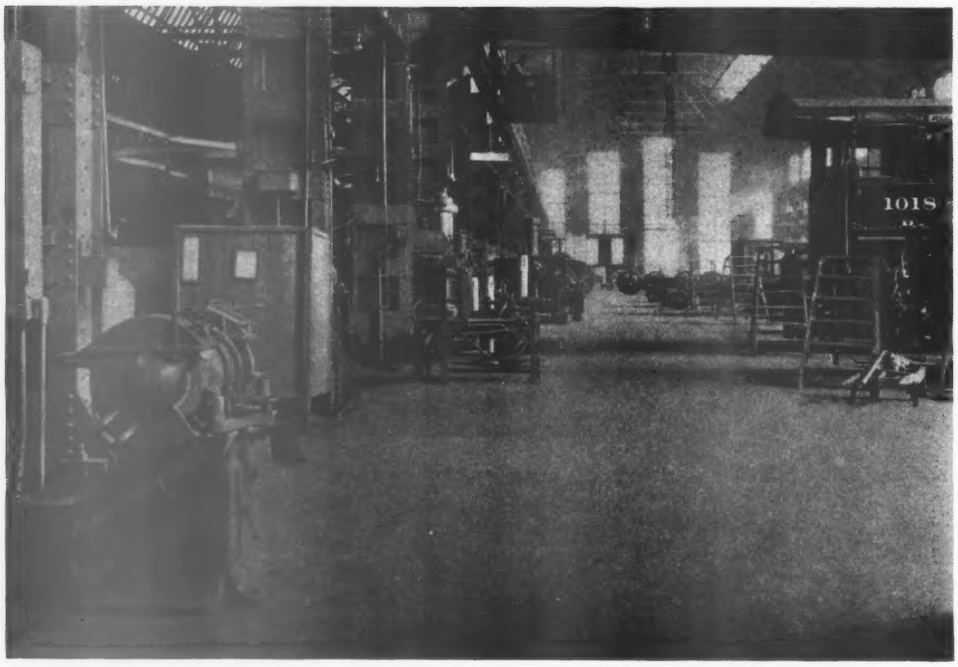
The locomotive accident reports give over a thousand piston-rod and crosshead failures per year. Most of those failures may have been caused by a lack of exactness in the most essential detailing of taper end of piston rod key and slot.

Piston-rod failures may be divided into two main classes: (1) Failure at the small end of the taper fit, and (2) failure at the large end of the taper fit. Most failures at the small end start the first day the key is driven into place. The key, lacking substantial supporting metal, simply will not stay put and the only recourse is the use of the hammer. The severe wedging action of the key and reverse stresses start cracks and promote early failure.

Nearly all failures at the large end of the taper seat may be caused by eccentric loading. The crosshead-pin vibrations may concentrate at this point because the cross-sectional area of the piston rod is less than the body. It is believed by engineers that were the taper seat increased in diameter by 25 per cent all stresses and high vibrations might be transferred to the body of the piston rod and there harmlessly eliminated.

FRANK RATTEK.

IN THE BACK SHOP AND ENGINEHOUSE



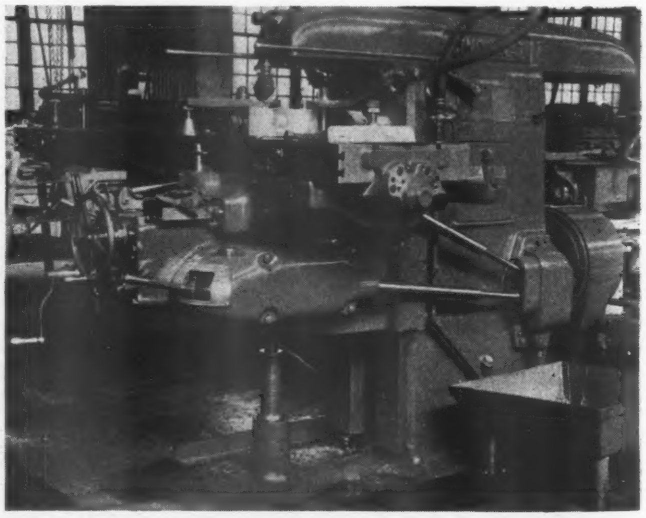
The Danville locomotive erecting shop has been improved by a new concrete floor

Locomotive Shop Improvements at Danville

During the past two years the Chicago & Eastern Illinois has made a number of improvements at its main locomotive repair shop, Danville, Ill., which are expected to have important effects in improving the quality and reducing the cost of locomotive maintenance work on this railroad. Included in the improvement program has been the installation of 10 modern machine tools, 10 electric floor grinders, 7 new electric drives to existing machines, 1 electric-driven pipe bender and 5 Ingersoll-Rand pneumatic hoists. This new equipment, installed at a cost of approximately $125,000, replaces at least 40 antiquated, worn-out shop tools which were scrapped. In addition, a pair of Whiting 25-ton car hoists has been purchased and temporarily installed in the boiler shop where several tracks are assigned to car work pending the building of a new coach shop to replace the one destroyed by fire several months ago. An important improvement in the erecting shop has been the installation of a new concrete floor.

The Danville locomotive machine shop is a brick structure 620 ft. long by 150 ft. wide, equipped with 28 locomotive repair pits, spaced 22 ft. apart on centers in the south half of the building which faces the transfer table. The machinery bay in the north half of the locomotive shop is provided with the necessary equipment for the expeditious handling of the many machine operations required in machining and repairing locomotive parts. Locomotives are unwheeled and wheeled by means of a 100-ton crane in the erecting shop which leaves the transfer table, with which the shop was originally equipped, free for the almost exclusive handling of passenger equipment to the coach shop and storage tracks south of the table. A second crane in the erecting shop, of 15-ton capacity operates under the 100-ton crane and is used for the handling of heavy locomotive parts.

One of the first improvements made at the Danville shops was the application of a new concrete floor in the erecting shop to replace the wood floor formerly used. Approximately 43,000 sq. ft. of concrete was laid 12 in. deep, the entire length of the erecting shop. While representing quite a substantial outlay, the advantages gained were decidedly worth while and will be realized for many years to come. Truck operations and the movement of material, for example, are greatly facilitated; floor maintenance is eliminated which saves at least $900 a year, formerly spent renewing the planking; locomotive maintenance work is no longer interrupted while making floor repairs; it is easier to keep the floor clean and accident possibilities are reduced.



Cincinnati No. 5 plain miller set up for machining a side rod on the 66-in. table

In the machine department practically all machine tools have been re-arranged and placed for the more effective handling of the work. Monorail hoists and jib cranes are installed, as shown in the illustration, to facilitate material handling to the various machine tools. For example, one monorail hoist equipped with a 2-ton Ingersoll-Rand machine serves six tools, including a radial drill, a 50-ton hydraulic press, two draw-cut shapers, one boring mill and one slab miller. This serves all machines in the driving box gang. Jib cranes are installed to serve all heavy machine tools as needed. Four 1-ton Ingersoll-Rand hoists replace cylinder air hoists, providing faster and safer handling of heavy material.

New Machine Installations

Some of the most important of the new machine tools installed at Danville shops are listed in Table I. They replaced the following machines which were scrapped; 7 planers, 2 shapers, 9 engine lathes, 3 turret lathes, 4 boring mills, 4 drill presses, 1 pipe bender and 10 grinders.

Almost no change was made in the wheel department except for the rearrangement of existing machine equipment to provide for more orderly handling of the work. Most of the new tools were installed for the use of gangs specializing on the following work: driving boxes, rods, pistons and crossheads, valve gears, etc. The Ingersoll milling machine and the Bullard 42-in. vertical turret lathe went to the driving box gang; the Bullard 24-in. machine and the Micro grinder to the rod job; the American heavy-duty engine lathe and radial drill to the piston and crosshead job; the No. 5 Cincinnati miller to the valve job; the Pratt & Whitney lathe to the tool room; the Jones & Lamson turret lathe to the general machine department; and the 10 floor grinders were installed wherever they could be used to the best advantage throughout the shop.

The first tool shown in the list of new machine installations is the Ingersoll slab miller which is used for machining driving boxes, shoes and wedges, crosshead shoes, engine truck and trailer boxes, guides, etc., both new and repair work. It is estimated that the machine saves at least 35 per cent in time and labor cost over previous methods of machining these parts on planers. For example, 24-in. brass shoes and wedges were formerly machined from rough castings at the rate of 14 hr. per set of 16, using two settings on a planer. These shoes and wedges are now machined two at a time while held in a special jig on the Ingersoll machine, finishing five surfaces simultaneously at the rate of six shoes and wedges an hour, or roughly 3 hr. for the 16 shoes and wedges. A cutting feed of 4½ in. per min. is used and, after the original allowance of one hour for setting up the jig in the machine, about 5 min. is required for adjusting and clamping each pair of shoes and wedges.

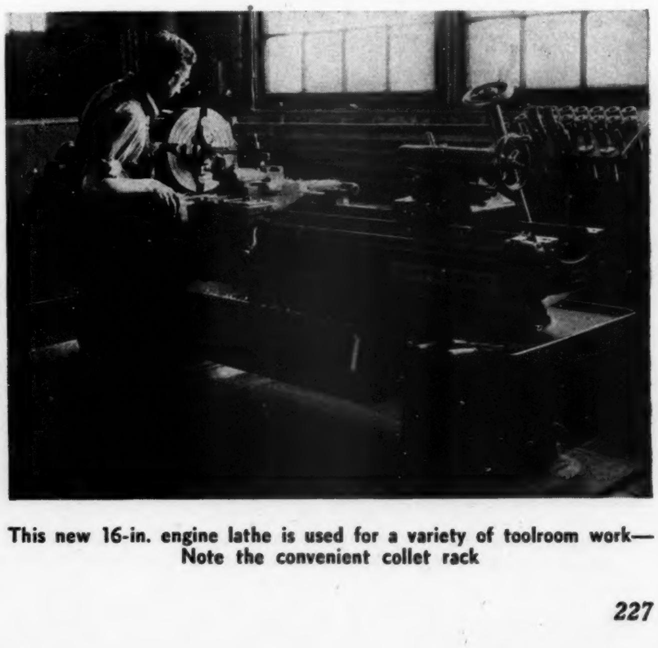
Like all new machines installed at Danville shops, the Ingersoll miller is fully equipped with necessary special fixtures and cutting tools, without which the investment in the machine itself can never bring satisfactory returns. In this case, the fixtures include one driving box fixture, one shoe-and-wedge fixture, one cross-head fixture, one arbor support, both serrated and inserted blade cutters, arbor mills, nut shanks and a solid shank 3½-in. boring bar. The larger fixtures and tools are kept safe off the floor on a steel rack of ingenious design, conveniently located with respect to the miller. Small tools and milling cutters are kept in a special steel locker with wood-lined shelves. The objective, of course, is to keep all special tools used with this machine in good condition and have them conveniently available where and when needed.

Table I—New Machines Installed at Danville Shops

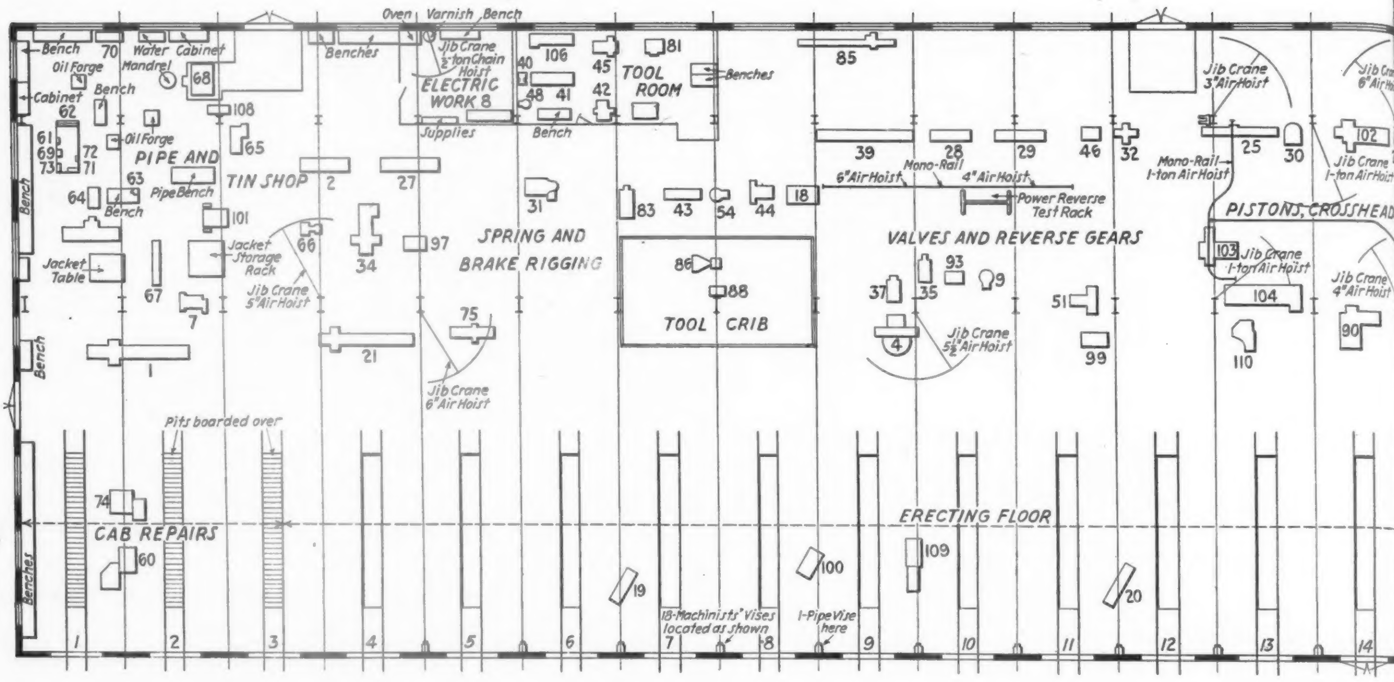
87—Bullard 42-in. spiral-drive vertical turret lathe
89—Jones & Lamson 3½-in. turret lathe
90—American 6-ft. radial drilling machine
91—Bullard 24-in. spiral-drive vertical turret lathe
100—Toledo No. 999 pipe threading machine
101—Wallace No. 424 pipe-bending machine
102—Micro railroad-model internal grinding machine
103—Cincinnati No. 5 plain high-power milling machine
104—American 27-in. by 96-in. heavy-duty engine lathe
105—Ingersoll 36-in. by 36-in. by 12-ft. railroad-type 3-head milling machine
106—Pratt & Whitney 16-in. by 66-in. toolroom lathe
...—U. S. motor-driven ball-bearing floor grinders (10)
...—Ingersoll-Rand pneumatic hoists (5)
...—Whiting 250-ton portable car hoist (2)
Cullman individual electric motor drives applied to:
24-in. engine lathe, No. 2
24-in. shaper, No. 83
20-in. engine lathe
18-in. nut facer, No. 18
Milling machine, No. 44
16-in. engine lathe, No. 43
20-in. engine lathe, No. 39

The Bullard 42-in. spiral-drive vertical turret lathe is used for machining large crown brasses, piston heads, valve bushings and similar work, also for boring cross heads for the piston and wrist-pin fits. In the latter work, accurate taper and smooth finish are absolutely essential in order to minimize the subsequent hand lapping operation. A special driving box chuck is used when boring

Close-up view of milling cutters finishing five surfaces simultaneously — The chip formation tells its own story



This new 16-in. engine lathe is used for a variety of toolroom work—Note the convenient collet rack



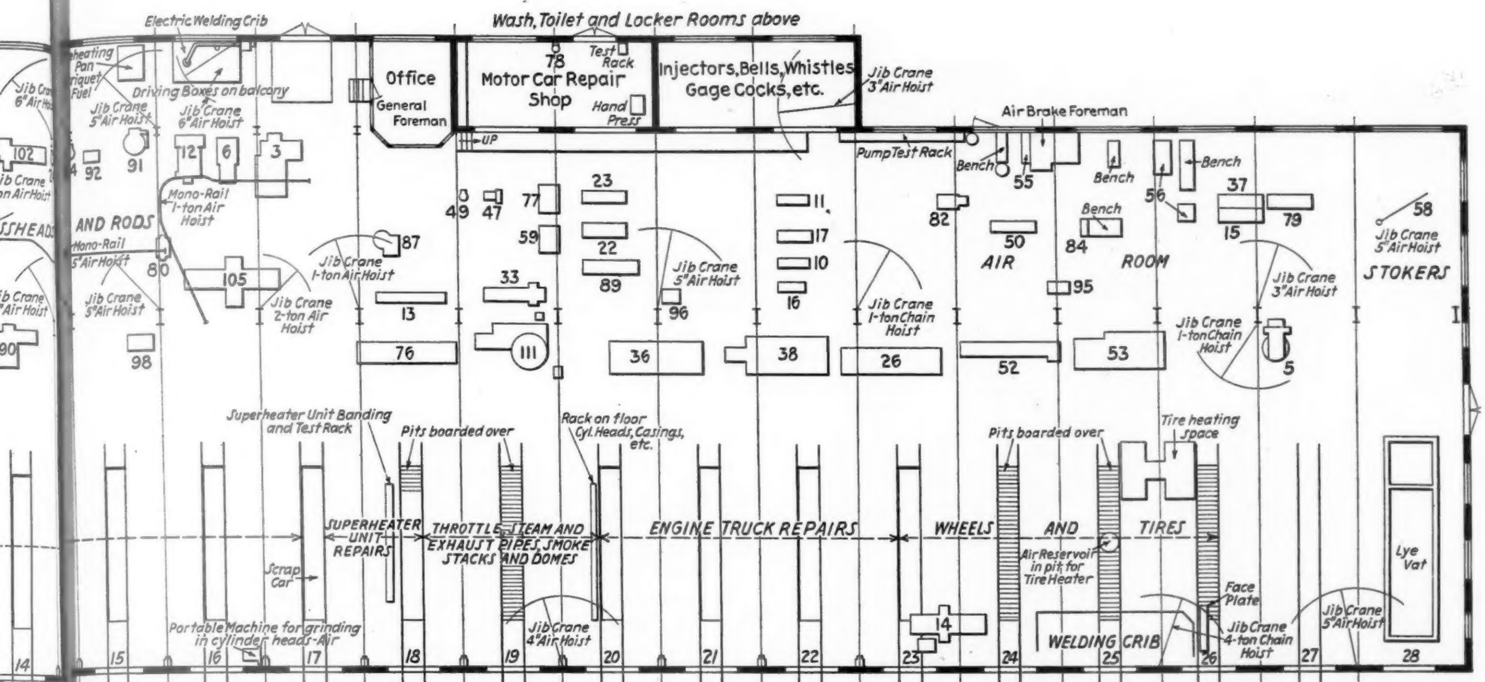
Layout of machine tools and shop facilities in

Wallace portable hydraulic pipe-bending machine which bends cold all sizes up to 4 in.

Jones & Lamson 3½-in. turret lathe as set up for the production of engine bolts from bar stock

Machine Tool and Equipment Units in the Danville Shops

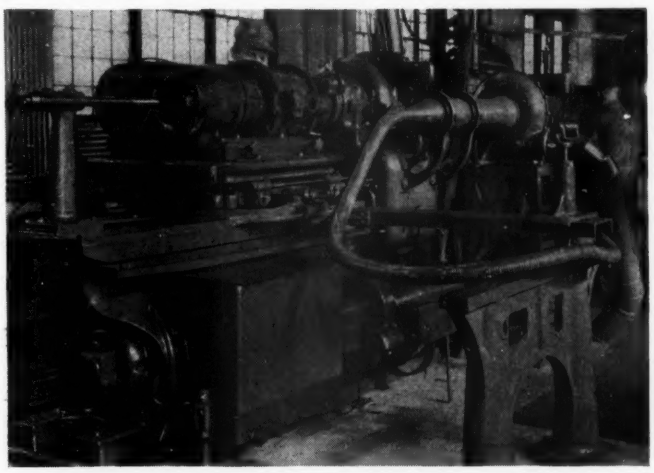
Machine No.	Location, Pit No.
1—48-in. planer	1
2—24-in. lathe	3
3—72-in. radial drill	17
4—51-in. boring mill	9
5—18-in. slotter	27
6—32-in. draw-cut shaper	16
7—Liner press	2
8—16-in. lathe	5
9—Sensitive drill	10
10—16-in. lathe*	22
11—24-in. lathe*	22
12—26-in. draw-cut shaper	16
13—22-in. engine lathe	18
14—30-in. horizontal miller	23
15—3T triple test rack	27
16—14-in. lathe*	22
17—18-in. lathe*	22
18—Nut facer	8
19—16-in. portable bolt lathe	6
20—18-in. portable bolt lathe	11
21—36-in. planer	4
22—2-in. by 30-in. turret lathe	20
23—2-in. by 30-in. lathe*	20
24—Sensitive drill	14
25—30-in. gap grinder†	13
26—42-in. axle lathe	23
27—27-in. lathe	4
28—18-in. lathe	10
29—18-in. lathe	11
30—50-in. upright drill	13
31—48-in. upright drill	6
32—50-ton hydraulic press	12
33—30-in. planer	19
34—24-in. guide grinder*	4
35—26-in. shaper*	10
36—85-in. quartering machine*	20
37—18-in. lathe	9
38—90-in. wheel lathe	22
39—24-in. lathe	9
40—Sensitive drill	6
41—16-in. lathe	6
42—Universal grinder	6
43—16-in. lathe	7
44—Universal miller	8
45—Toolroom miller	6
46—Disc grinder	11
47—Milling machine*	19
48—24-in. upright drill*	6
49—Sensitive drill	19
50—18-in. lathe*	24
51—Milling machine*	11
52—600-ton, 90-in. hydraulic press	24
53—84-in. wheel lathe	25
54—10-in. slotter*	8
55—Gage and safety-valve tester	24
56—Test racks	26
57—3T triple test rack	26
58—Jib crane	27
59—2-in.-3-in. bolt threader*	19
60—42-in. band saw	1
61—Folder	1
62—42-in. rolls	1
63—Shear	2
64—36-in. shear	1
65—6-in. pipe threader	3
66—Sensitive drill	3



he Danville locomotive shops of the C. & E. I.

Machine No.	Location, Pit No.
67—8-ft. Cornish hand brake	2
68—Babbitting forge	2
69—Beader	1
70—Pneumatic pipe clamp former	1
71—30-in. rolls	1
72—Turret punch	1
73—20-in. roll	1
74—No. 2 rip saw	1
75—Punch and shear	5
76—Putnam 36-in. by 18-ft. lathe	18
77—1½-in.-3-in. bolt threader*	19
78—Sensitive drill	20
79—3T triple test rack	27
80—50-ton hydraulic press	15
81—Universal and toolroom grinder	7
82—48-in. radial drill	23
83—24-in. shaper	7
84—Hydraulic gage tester	25
85—6-in. high-speed hack saw	9
86—Wet or dry drill grinder	7
87—42-in. vertical turret lathe	18
88—Small grinder	7
89—3½-in. by 2-in. by 15-in. turret lathe	20
90—72-in. radial drill	14
91—24-in. boring mill	15
92—2-hp. floor grinder	15
93—2-hp. floor grinder	10
94—2-hp. floor grinder	7
95—7½-hp. floor grinder	24
96—7½-hp. floor grinder	21
97—7½-hp. floor grinder	4
98—7½-hp. floor grinder	15
99—7½-hp. floor grinder	11
100—½-in. to 2-in. pipe threader and cutter	8
101—1-in. to 4-in. portable pipe bender	2
102—Internal grinder	14
103—No. 5 plain milling machine	12
104—27-in. piston lathe	13
105—36-in. by 36-in. by 12-ft. milling machine	16
106—16-in. by 66-in. toolroom lathe	6
107—Rotary jacket shear	1
108—Crosshead shoe babbitting form	3
109—Portable cylinder boring machine	9
110—Pneumatic piston bull ring riveting machine	13
111—84-in. boring mill	19

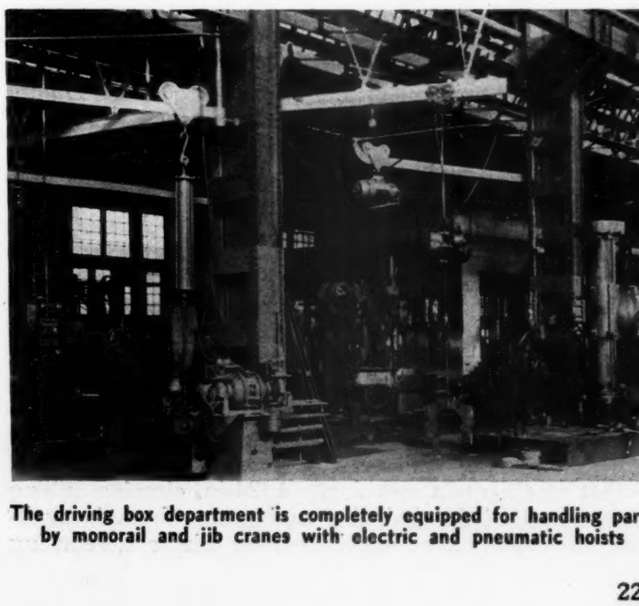
* Belt drive.
† Belt and motor.



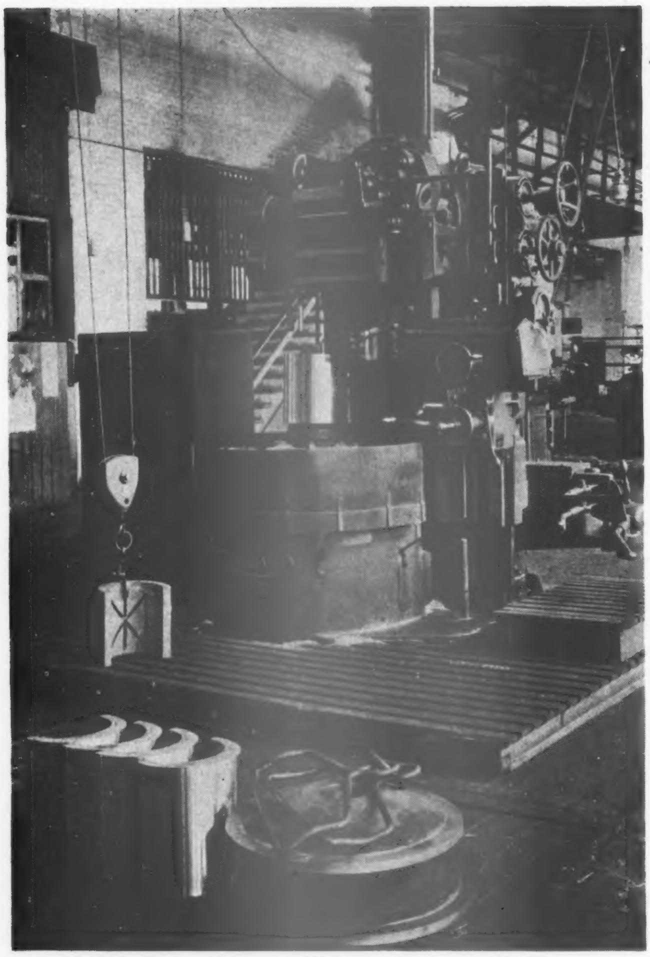
Micro internal grinder with indexing table for "in-line" grinding of air compressor cylinders

boxes, this chuck saving set-up time and contributing to accuracy. A saving of approximately 40 per cent is effected in the machining time required for this operation with the old driving box mill.

The Bullard 24-in. spiral-drive vertical turret lathe, equipped with a 3-jaw combination chuck and all necessary tool holders, boring bars, cutting tools, etc., is used for manufacturing rod brass bushings, side rod collars, small crown brasses, hub liners, valve bushings, and similar parts.



The driving box department is completely equipped for handling parts by monorail and jib cranes with electric and pneumatic hoists



Bullard 42-in. vertical turret lathe used in turning crown brasses, cylinder heads, etc.—Note special lifting devices

This machine saves about 35 per cent in the cost of doing this work over former methods on engine lathes. The machine is a versatile tool, well adapted to production jobs requiring a high degree of accuracy, and also useful on small odd jobs such as turning fibre washers referred to elsewhere in this article.

The uses of the Micro internal grinder are too numerous to mention in their entirety. The machine is well adapted for the accurate and rapid regrinding of air compressor and power reverse gear cylinders, truing side and main rod holes, brass fits, etc. A link-grinding attachment is available to grind any radius up to 100 in. An extra spindle, which finishes 2½-in. to 5-in. holes 13 in. deep, is used for grinding firedoor cylinders, motor car cylinders, etc. New uses are continually developing for this machine and it will doubtless have to be operated on two shifts if and when the shop starts working again at full capacity. Incidentally, double shifting will then be necessary on most of the other new machines.

The Cincinnati No. 5 heavy-duty plain miller, illustrated, is used for general milling operations, being equipped with a 66-in. table to do larger work, such as side rods. The Danville shop was never previously equipped with a milling machine of this capacity and flexibility, and attachments are available for handling many different kinds of work accurately and on a production basis. These attachments include a heavy vertical milling head with one-to-one ratio of spindle speed to that of the main machine. A 24-in. circular milling table, arranged for indexing and power feed, is available. Necessary arbors, spindle nose adaptors, reducing collets, vices and chuck are provided, exceptional care being taken to keep these attachments and tools in the best of condition for immediate use, as in the case of those furnished with the Ingersoll miller.

The American 27-in. by 96-in. heavy-duty engine lathe, installed on the piston and crosshead job, is used in making piston rods, crank pins, and other parts in which the accuracy of this machine, as well as its productive capacity, make it a valuable addition to the shop equipment. The same may be said of the American 6-ft. radial drill installed near this engine lathe. On both machines, an adequate supply of coolant is piped to the cutting tool where it is employed when necessary to use heavier cutting feeds and speeds. On the lathe a built-in chip and coolant pan is provided, also a roller-bearing tail-stock center, dual direct-reading across dials, taper attachment, combination plain block nest with 4-way tool holder, 24-in. 4-jaw independent chuck, chip breaker, etc.

The Pratt & Whitney 16-in. tool room lathe swings 18½ in. over the ways, takes 66 in. between centers and has 18 speeds from 16 to 1,000 r. p. m. The spindle operates in pre-loaded Timken roller bearings. Taper and relieving attachments are provided, also a drawing-in attachment with 15 No. 6 collets, varying from ⅛ in. to 6 in. by sixteenths. The machine is equipped with the usual independent and universal chucks, including a drill chuck with arbor attachment for the tail stock. From the point of view of accuracy, ease of operation, range and variety of work handled, this new lathe so far surpasses the old tool room lathe which it replaced that no real comparison can be made.

The Jones & Lamson 3½-in. turret lathe is used in the general small machine department for making all kinds of brake and spring pins and bushings, studs, bolts, etc. It is an accurate high-production tool which saves at least 25 per cent in time and labor cost, as compared with the worn-out and inadequate turret lathes formerly used. On the present basis of shop operation at Danville, this machine is used on relatively short-run orders, so its real value will not be demonstrated until production picks up and the shop gets back on a normal basis.

The Wallace electric-driven pipe-bending machine, installed in the pipe shop, is used for bending all locomotive pipes, ½ in. to 4 in. in size, by means of suitably-indexed, 4-side holding blocks and an hydraulic ram equipped with a die of the proper size. These pipe bends are made cold, thus saving the cost of delay of heating. The Toledo super-model pipe-threading machine, also installed in the pipe shop, is an important addition, owing to the fact that ½-in. to 2-in. threads are cut on a high production basis, with close tolerances which greatly improve bolt and nut connections. The machine has a pipe cutting attachment and a reamer to remove inside burrs. Die life is increased not only by the quality of tool steel used and its heat treatment, but by the powerful and steady feed and cutter drive. The machine is equipped with six quick-opening die heads and one right-hand pipe die for each size from ½ in. to 2 in.

Ten U. S. electric floor grinders, located at strategic points throughout the shop, tend to minimize extra steps and lost time in handling the many small hand-grinding operations which must be performed in all locomotive shops. Six of these machines are driven by 7½-hp. a. c. motors, each direct connected to an 18-in. by 3-in. grinding wheel and operating at 1,120 r. p. m. The other four grinders have 12-in. by 3-in. wheels operating at 1,750 r. p. m. and driven by 2 hp. a. c. motors. The minimum diameter of hood outlets is 4½ in. in each case.

Cullman individual motor drives have been applied to

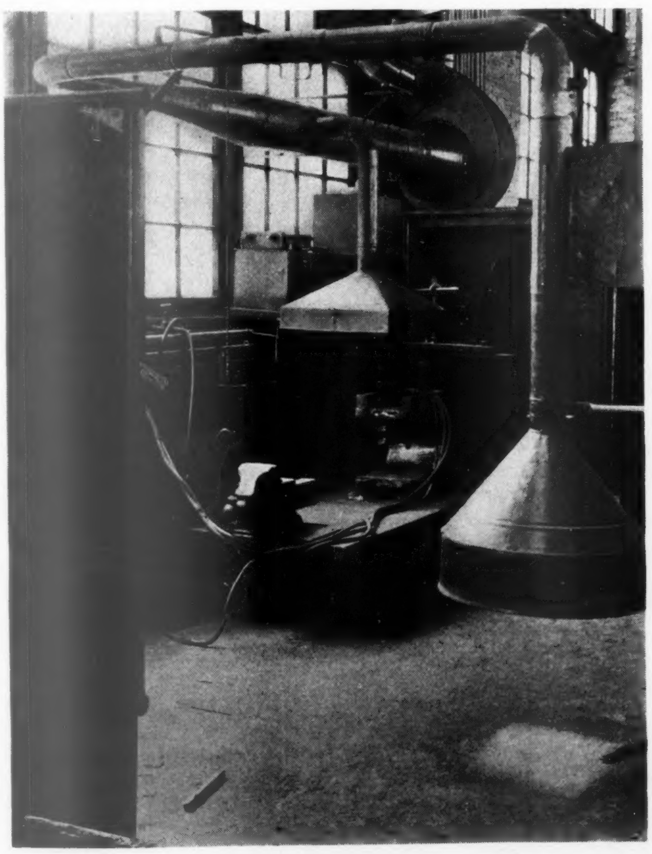
seven lathes, shapers, millers, etc., as shown in the list, replacing overhead line shafting and belts with attendant maintenance cost, loss of power while machines are idle, and lack of flexibility as regards changing machine locations. With individual electric drive, these lathes and other tools have been located wherever they can be placed to best advantage in each shop sub-department.

The five Ingersoll-Rand pneumatic hoists include one of 2-ton capacity and four of 1-ton capacity. These hoists have proved to be fast, accurate and durable, requiring minimum expenditures for repairs.

Each important machine at Danville shops is equipped with a steel locker for the safe and convenient storage of tools while not being used. The provision of a suitable place to hold these tools which is handy to the machine operator saves a lot of time in the aggregate and in addition, much damage and loss of small tools is avoided. With the same objective, floor racks are provided, when necessary, to keep all machine attachments off the floor and also conveniently available. Special wrenches and other tools of large size are kept in ingenious locked racks where they are available only to men authorized to use them.

Welding Booth Equipped with Exhaust Hoods

In addition to the main welding booth in the Danville locomotive erecting shop, a smaller 12-ft. by 14-ft. booth has been installed under the balcony adjacent to the driving box job, where it is used primarily in welding cracked driving boxes, applying Mez metal side bearing liners and also steel shoe and wedge liners. A Lincoln portable 600-amp. welding machine is used in this booth which is equipped with a low steel-covered table to support driving boxes about 18 in. above the floor, and a small rotating plate which is conveniently used to rotate and support the box at floor level when this is desirable.



The welding booth is equipped with a convenient and effective exhaust system

Referring to the illustration, the very compact and efficient exhaust system used in getting rid of noxious gases and fumes is clearly shown. It consists of a 1½-hp. electric motor, direct connected to a 20-in. exhaust fan with an 8-in. intake which tapers down to 4 in. sheet metal pipe connections to the hoods. The feature of these hoods is the fact that they can be easily adjusted up or down and in addition, swung up entirely out of the way when not needed. Slides are provided to regulate the draft.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Distinction between "Working Pressure" And "Allowed Working Pressure"

Q.—Rules 34 and 35 on safety valves in the 1929 edition of the I. C. C. laws, rules and instructions for inspection and testing of steam locomotives and tenders and their appurtenances states in part:

"*34. Number and Capacity*—Every boiler shall be equipped with at least two safety valves, the capacity of which shall be sufficient to prevent, under any conditions of service, an accumulation of pressure more than 5 per cent above the allowed steam pressure.

"*35. Setting of Safety Valves*—Safety valves shall be set to pop at pressures not exceeding 6 lb. above the working steam pressure. When setting safety valves, two steam gages shall be used, one of which must be so located that it will be in full view of the person engaged in setting such valves; . . . . ."

In these two rules it will be noted that rule 34 refers to "allowed steam pressure" and rule 35 refers to "working steam pressure." Would you kindly advise me as to what the distinction is between allowed steam pressure and working steam pressure as used in these rules?

Also, the form of the specification card in the I. C. C. rules calls for the maximum stresses for the allowed working pressure while in the affidavit the inspector signs that the boiler is safe for a working pressure. Is there any distinction between "allowed working pressure" and the "working pressure" as used in connection with the specification card and affidavit?—A. L. P.

A.—This question was submitted to J. M. Hall, chief inspector of the Bureau of Locomotive Inspection, who has submitted the following answer:

"The term 'allowed steam pressure' means the pressure fixed by the carrier in conformity with rule 1. This is the pressure upon which the stresses shown on the specification card are based and it must be such that the boiler will have at least the minimum factor of safety of four as specified by rule 2, and the stresses on stays and braces must not be more than the maximum permitted under rule 3.

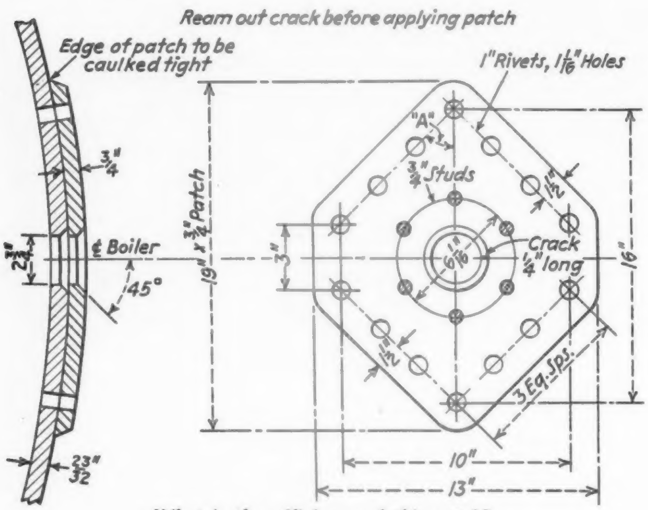
"The term 'working steam pressure' means the maximum nominal pressure at which the boiler is operated, and is likewise fixed by the carrier; it may be the same as the 'allowed steam pressure' or less, depending on the option of the carrier. The specification card may

be compiled, if desired, on the basis of the lower pressure, and in the event it is later desired to increase the pressure, this may be done after proper tests and inspections are made and required reports filed."

The Efficiency of a Patch For a Boiler-Check Hole

Q.—What is the efficiency of the boiler-check patch shown in the accompanying illustration?

A.—An examination of this patch indicates that its lowest efficiency will be along the outside row of rivets.



What is the efficiency of this patch?

The efficiency along the outside row of rivets is determined by the formula

$$E = \frac{2\,(p - d)}{p\sqrt{3\,(\sin A)^2 + 1}}$$

where E = efficiency; p = diagonal pitch, in., and d = diameter of rivet hole, in. From the drawing:

$$p = \frac{\sqrt{(5^2 + 6.5^2)}}{3} = 2.73 \text{ in., and } \sin A = 5/8.2 =$$

0.6097. Substituting these two values in the foregoing formula, we have

$$E = \frac{2\,(2.73 - 1.0625)}{2.73\sqrt{3\,(0.6097)^2 + 1}} = \frac{3.335}{3.9585} = 0.842.$$

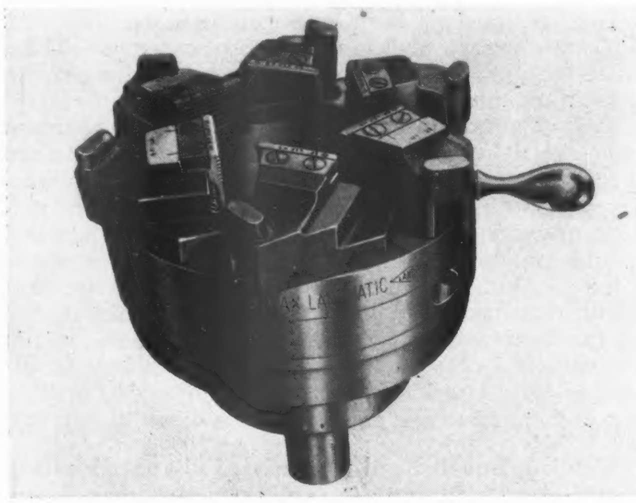
Therefore, the efficiency of the patch is 84.2 per cent.

Die Head for Large Diameter and Long Threads

The Landis Machine Company, Waynesboro, Pa., has added to its line of threading equipment the illustrated 40AX Landmatic die head for threading large diameters of long thread lengths. The diametral capacity of the head is 4 in. to 5⅛ in. with a pitch range of 7 to 20 threads per in. Thread length, while not unlimited, is sufficient to take in a large range. The head illustrated has a thread-length capacity of 7 in. on a 5⅛ in. diameter.

The die head belongs to the Landis Landmatic series and is of the self-opening, pull-off type for application to turret lathes and hand-operated screw machines. It is heat-treated throughout and ground for maximum wearing qualities. Diametrical graduations on the circumferential surface and micrometer graduations on the adjusting screw are used to insure rapid and accurate size changes.

The 40AX head carries six chasers mounted on the face of the head similar to the four-chaser die head. By



The Landmatic 40AX die head with a diametral capacity of 4 in. to 5⅛ in. with a pitch range of 7 to 20 threads per in.

using six chasers instead of four, the cutting load is more widely distributed. Thus, the working parts of the head as well as the part being threaded are subject to less cutting stress. This is said to result in an increase in tool life with more threads obtained per grind of the chaser, improved quality of the product being threaded, and also an increase in the life of the die head.

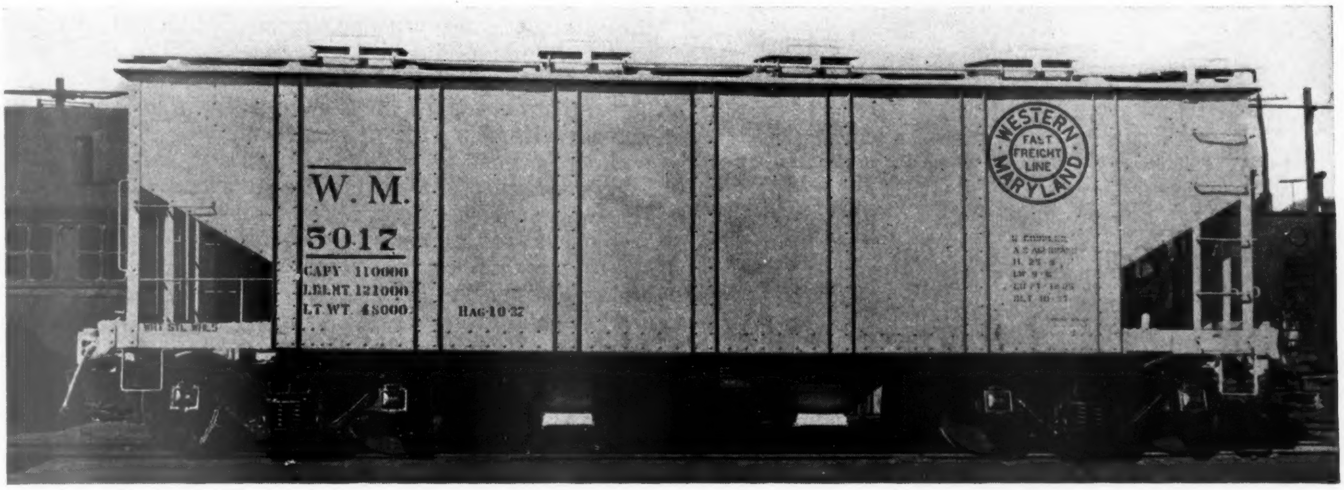
Electrode for Parts Subject to Heavy Impact

The Harnischfeger Corporation, Milwaukee, Wis., announces an addition to its line of Smootharc welding electrodes which is called "Harmang." Designed for welding on parts subject to heavy impact, these electrodes supply the necessary toughness and hardness demanded. Its base metal is nickel-manganese steel, ranging from 11 per cent to 14 per cent nickel-manganese, and 3½ to 4½ per cent nickel. Carbon content is in excess of one per cent.

The slag coating which stabilizes the arc and protects the metal against loss of carbon and manganese is kept to a minimum so as not to interfere with the rapid cooling required to form an austentitic deposit. With cold working, such as hammering and peening, the soft manganese deposit becomes an extremely hard martensite layer which offers great resistance to impact and abrasion. Harmang operates with the work negative and the electrode positive, and is built in sizes from ⅛ in. to ¼ in. diameter for use with currents ranging from 90 to 140 amp.

A FAMOUS RAILROAD—Arkansas has the world's most famous railroad. It goes through the Dardanelles (Dardanelle, Ark.), it crosses the Delaware (Delaware Creek), it is in sight of London (London, Ark.), it passes through Subiaco, where is located a monastery named after the one in Italy, and terminates at Paris (Paris, Ark.). The name of this railroad is the Fort Smith, Subiaco & Rock Island.

With the Car Foremen and Inspectors



The completed bulk-cement car

Coal Hoppers Converted To Bulk-Cement Cars

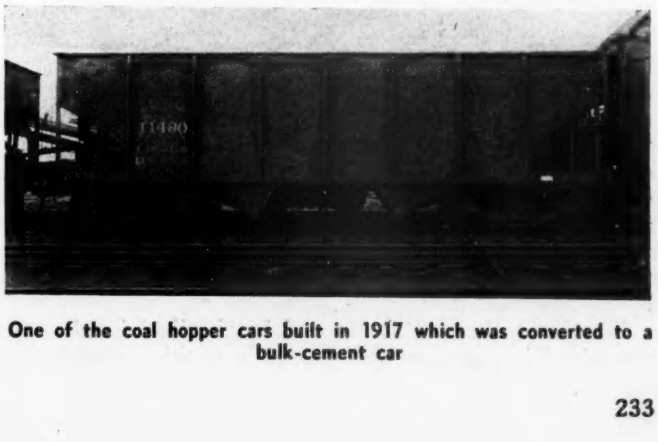
The Western Maryland recently constructed 20 all-steel bulk-cement cars on basic parts salvaged from dismantled coal hopper cars. All body sheets in contact with the lading are new, and all rivet heads on the inner side are countersunk to give a smooth surface for the free discharge of cement. In addition to riveting, all inside seams are welded to increase rigidity of the car body and guard against possible development of crevices through which cement might escape. The inside of the car body was not painted, but was sandblasted to remove all roughness and scale. The exterior of the car body is painted with a special alkali-resisting cement car paint, of approximate cement color, so that a neat appearance can be maintained with a minimum expense. The general dimensions, weights and capacities of the cars are given in the accompanying table.

General Dimensions, Weights and Capacities of the Bulk-Cement Cars

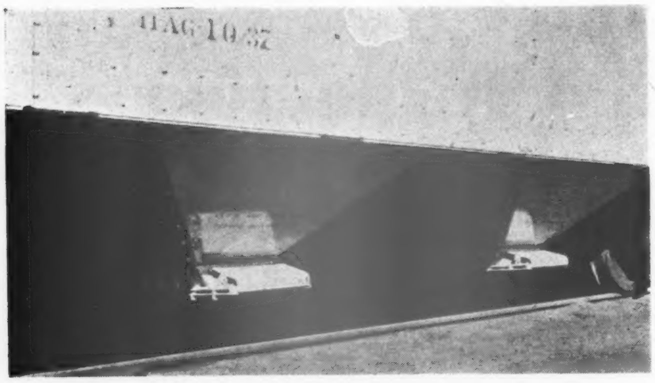
Length inside, ft. and in.	25- 9
Length over striking plates, ft. and in.	32- 3
Length over pulling face of couplers (normal), ft. and in.	34- 9
Length over running boards, ft. and in.	32-11
Truck wheel base, ft. and in.	5- 6
Width inside, ft. and in.	9- 6
Width over roof eaves, ft. and in.	10- 3
Height from rail to top of roof hatches (highest point), ft. and in.	11- 8½
Height from rail to center-plate bearing surface, ft. and in.	2- 3¾
Height from rail to center of couplers, ft. and in.	2-10½
A. A. R. Load limit, lb.	169,000
Light weight, average, lb.	48,000
Live-load limit, lb.	121,000
Volumetric capacity, cu. ft.	1,425
Cement capacity @ 85 lb. per cu. ft., lb.	121,125
Lump-lime capacity @ 65 lb. per cu. ft., lb.	92,625

The coal hopper cars, built in 1916 and 1917 of conventional design, were in a worn-out condition in 1937, with obsolete draft gears and couplers, air brakes, hand brakes and door fixtures, and were due for complete rebuilding, to either a modernized car of the same or other type. In this case, 20 cars were rebuilt to a design suitable for shipment of bulk cement, to handle anticipated traffic requirements along that line. The rebuilt bulk-cement cars are the result of a studied effort to please both the cement companies and the receivers of shipments of bulk cement. When these cars are loaded, the cement is usually pumped from the silos to the roof hatches, through a hose about 8 in. in diameter, and it is necessary that the hatches be of a height, dimensions, and arrangement suitable for this operation, and the discharge gates must be adapted to standard unloading facilities. The cement is loaded in an aerated fluid condition, but becomes compact from the vibration in transit, and on this account the cars were built as smooth as possible inside, and the slope sheets were given an angle of 44 deg. to aid in speedy unloading of the compact cement at its destination.

The coal hopper cars were dismantled as far as required for the new construction, and in addition, removal was made of parts requiring repairs or renewal on account of bad condition. The underframes were thoroughly examined for cracks or distortions, and repaired when necessary. Center sills were reinforced by the addition of a heavy one-piece top cover plate extend-



One of the coal hopper cars built in 1917 which was converted to a bulk-cement car



The discharge hoppers with Wine discharge gates

The cement cars are equipped with Chicago-Hutchins Dry-Lading steel roofs and water-tight hatches

ing full length; also, they were reinforced at each end with bottom cover plates between the hoppers and bolsters. The center sills were adjusted and repaired when necessary and made ready for the application of cover plates. Bolsters, end sills and end sheets were reapplied when found in suitable condition for further service; otherwise, they were renewed.

The trucks were completely dismantled, every detail inspected and defective or worn parts renewed or repaired. They were originally equipped with integral cast-steel side frames, cast-steel bolsters, Barber lateral motion device and Stucki roller side bearings. They were improved by the application of Creco brake-beam safety guards, Creco bottom-rod guards and Wine brake balancers. The brake balancers connect the truck dead levers to the center sills, and relieve the truck bolsters of the eccentric thrust that results from brake applications when the lever is connected in the usual way to the truck bolster. The balancers were installed to reduce wear on wheel flanges and treads, side frames and bolster guides, variation in brake-shoe pressure when the truck swivels, downward loading on brake beam at the end of the car, and tendency for a light car to derail when brakes are applied.

All the dismantling and reconstruction previously described was completed in the outside car yard. The cars were then removed to the erecting shop, for application of side sheets, floor and hopper sheets, air brakes and other specialties, including the roofs, which were applied after the internal welding had been completed. Each car was then returned to the car yard for painting, air brake test, and final inspection before being placed in service by the railroad.

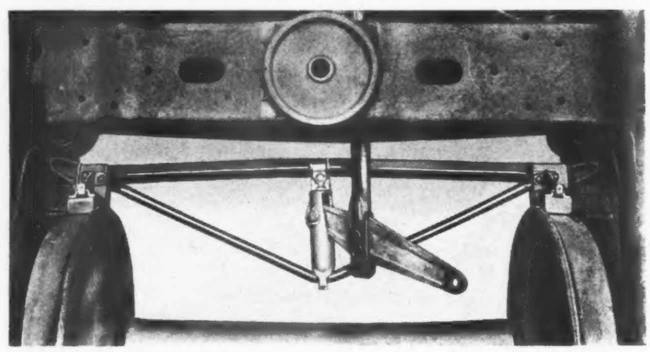
The inside hopper sheets and longitudinal hood were assembled in one piece and placed in position astride the center sills as a single unit. This unit is secured to the center sills at 10 different points by 38 rivets. When assembled, the rectangular tapered hoppers were too rigid to permit adjustment for the application and alinement of the Wine discharge gates with which the cars are equipped. For this reason, the discharge openings were fitted and bolted to a jig, which held them in the correct position until after the seam rivets were driven. The cement car has a center bulkhead made of a single ¼-in. plate, reinforced at the top by bulb angles and at the sides with heavy connecting angles securely riveted to the sides and hopper slope sheets. This bulkhead serves as a crosstie and lateral brace, and divides the lading so that one end of the car can be completely unloaded without disturbing the opposite end.

The car roof is of all-steel Chicago-Hutchins Dry-Lading design. The hatches are sufficiently high to prevent water entering the car; when sealed with the locking rods used, they are entirely waterproof.

Other specialties used with the car are Ajax hand brakes, Miner A-22-XB friction draft gears, Farlow draft gear attachments, A. A. R. Type-E couplers, and AB brakes, furnished by Westinghouse.

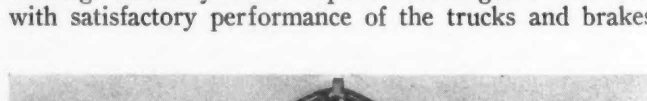
Report of Test With Unit Trucks

The Unit Truck Corporation, Jersey City, N. J., reports the completion of a test of its Unit Truck in 24-hour mill switching service on the South Buffalo Railway, Buffalo, N. Y. Unit Trucks, with a foundation-brake arrangement which has no brake-beam hangers, brake-beam supports or adjusting devices, were installed on



Foundation-brake arrangement of the Unit Truck—The brake-beam guides are cast integral on the inside of the frame

May 1, 1937, on the tender of the South Buffalo locomotive No. 30, and on May 2, 1938, after 80,000 brake applications had been made, it was found that the average wear on the brake-beam wear plates was but 1/64 in. Even and full brake-shoe wear and improved braking efficiency were reported throughout the test with satisfactory performance of the trucks and brakes



The brake-beam wear plates at the ends of the brake beam wore less than 1/64 in. during 80,000 brake applications

during the severe winter weather encountered during the test.

The Unit Truck differs from the conventional truck in that brake-beam guides are cast integral on the inside of the tension member of the cast-steel side frame adjacent to the car wheel with an opening into the side-frame window. They slope at an angle of approximately 12 deg. to the center line of the axle. The bottom section of the guide is a continuation of the spring seat.

Both the side-frame guides and the brake-beam bearing surfaces are protected by spring-steel wear plates which can be replaced when necessary. This foundation brake has 116 less parts and weighs 200 lb. per car less than previous designs. It was described completely in the June 21, 1937, Daily edition of the Railway Age. p. 1040D32.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.A.R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Car Destroyed by Fire When Located at Interchange Point

On January 10, 1936, the Union Pacific delivered to the Wabash on the recognized interchange track in the North Kansas yards of the Wabash, an ASIX tank car loaded with gasoline. After arrival on the interchange track, the car was found to be leaking at the bottom outlet extension and was set on the light repair track in the North Kansas City yards for repairs, where it caught fire and was destroyed.

The Wabash produced evidence showing that the bottom outlet extension was in bad order and maintained that the car was leaking when delivered to the interchange track. It further maintained that the car was not accepted by the Wabash inspectors, but that it could not be refused and therefore was removed to the nearest available point for repairs according to I. C. C. Bureau of Explosives rules, Pamphlet 20-J, paragraph 690, also section (b) of A. A. R. Rule 2.

The U. P. contended that the leak started after the car had been placed on the interchange track and reported that the interchange inspection report signed by the Wabash inspectors did not show that the car was to be rejected, but that it was to be shopped for repairs. The U. P. also pointed out that after the leak was discovered, the nearest repair tracks was on its own line, rather than on the Wabash. It produced evidence showing that the car was set on the interchange track at 9:30 a. m., was picked up by the Wabash and delivered to the repair track about 3:25 p. m., and repairs to the car were not started until 5:30 p. m., indicating that the Wabash repairmen considered the leak of no consequence. After repairs were started, the cap on the extension outlet fell off permitting the gasoline to gush forth, which caught fire and destroyed the car. The U. P. further pointed out that under a local interchange agreement, the car was in possession of the Wabash.

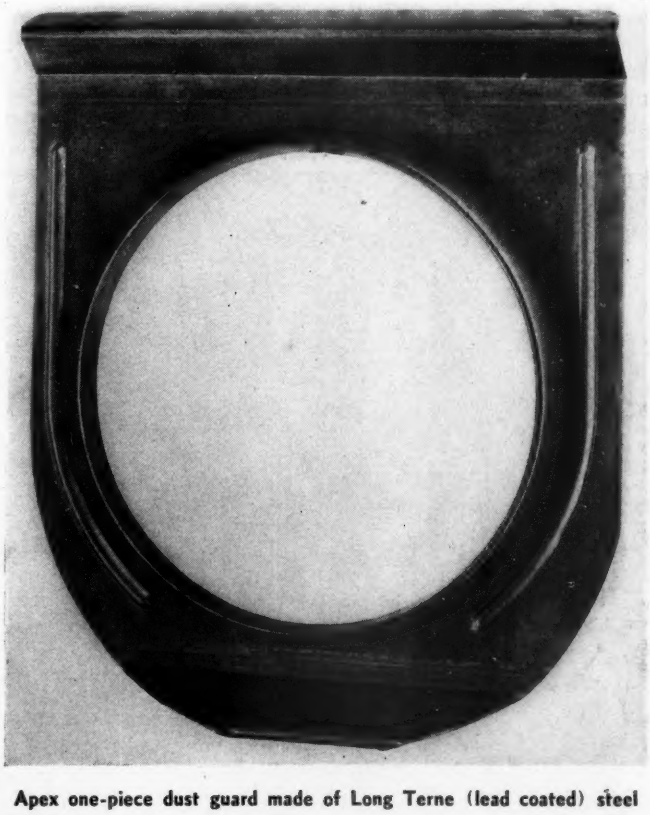
The Arbitration Committee stated in a decision rendered December 30, 1937, that: "The Wabash is responsible for destruction of the car, same being in its possession at time fire occurred."—*Case No. 1758, Wabash versus Union Pacific.*

Apex All-Metal Dust Guard

A new type of all-metal dust guard, designed to function effectively in retaining oil in freight-car journal boxes and keep dust and water out, has been given extensive service tests and is now being sold by the Apex Railway Products Company, Chicago. Special features of this dust guard include simplicity, ease of application without the use of special tools, long service life and the possibility of subsequent reapplication.

The Apex dust guard is pressed in one piece from 16-gage Long Terne (lead coated) steel. Spring-tension flares formed at the top and bottom of the dust guard allow for variation in well thickness and hold the guard firmly against the inner surface of the dust-guard well. The taper-flanged center hole has a clearance of 1/64 in. over the axle size and this design eliminates binding, since the taper flange allows ample angular movement of the car axle while negotiating curves. Small vertical ribs pressed on each side of the dust guard contribute additional stiffness and strength.

With a fixed clearance of 1/64 in. between this dust guard and the axle, the oil itself acts as a seal at this point to exclude dust and dirt. The guard fits snugly against the face of the well, making it possible to maintain the proper oil level for efficient lubrication. Being



Apex one-piece dust guard made of Long Terne (lead coated) steel

supported under its own spring tension, the dust guard is self-centering, thus compensating for axle movement and the wear of journal-box parts, as well as enabling

journal boxes to be jacked up for the removal of defective brasses without damage to the guard.

Dust and water are said to be entirely eliminated from the journal bearing by the use of this dust guard. Even when the plug is missing from the top of the well, protection is afforded the journal and bearing by the close contact between the upper flared portion of the dust guard and the well. This flare is designed to divert dust, dirt or water to the sides where it falls harmlessly to the bottom of the well.

The Apex dust guard, being made of heavy-gage metal, is not affected by excessive heat in the journal box nor by any water which might be applied to extinguish a hot-box. It will, therefore, not become charred or water-soaked and can always be removed intact, without difficulty. This dust guard is made in three sizes for axles having the following journal sizes: 5 in. by 9 in., 5½ in. by 10 in., and 6 in. by 11 in.

Two sets of special dies conveniently set up in the Ajax No. 10 bulldozer

New Bulldozer Expedites Car Work

Many bending and forming operations on steel car parts are now done with speed and precision at the Chicago & North Western car blacksmith shop, Chicago, on a new Ajax No. 10 steel-frame bulldozer which is notable not only for ease and flexibility of operation but for the variety of work which can be done on it. This work includes such operations as bending cold in one operation the 4¾-in. radius flange on 4-ft. by 6-ft. ore car doors, shaping underframe crossbearers, pressing the offset in passenger-truck pedestal plates, making the flanges on baggage-car striking blocks and bending all shapes and sizes of truck braces and hangers.

The new Ajax bulldozer, which replaces an obsolete and worn-out machine, is driven from a 30-hp. alternating current motor through dual reversing clutches, with electric controls conveniently located. One of the most important advantages of the machine from the point of view of shop production is that the heavy crosshead, with outboard guide bearings, can be stopped or reversed at any point in the stroke. Both clutches are operated from a rock shaft above the die space with horizontal levers extending to either side of the machine. A band brake of liberal diameter stops the machine with both clutches in neutral position.

A clutch and brake-timing mechanism permits operating the bulldozer automatically on single stroke, the operator merely engaging the clutch for starting. The timing mechanism can be made inoperative so as to require engagement and disengagement of the clutches manually. The multiple-disc type clutches provide an efficient overload protection by slipping when overloaded.

Improvements in the new bulldozer include, in addition to the welded steel frame and rear extension guide bearing for the crosshead, the use of Trunion type main gears. The provision of reversing individual motor drive without the use of bevel gears is also an important ad-

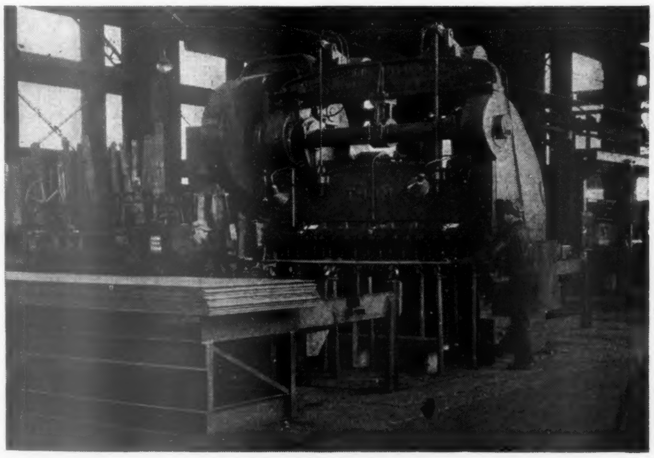
Ajax No. 10 motor-driven steel-frame bulldozer installed at the C. & N. W. car blacksmith shop, Chicago

The work done on the bulldozer includes the forming of underframe crossbearers, passenger-truck pedestal plates, baggage-car striking blocks, and truck braces and hangers of all shapes and sizes

vantage. The crosshead face, provided with conveniently located T-slots for attachment of the moving die, is 108 in. by 20 in. and 34 in.; crosshead traverse, 30 in.; die space, with crosshead forward, 66 in.; height of resistance lugs, 21 in.; crosshead strokes, 7 to 8 per minute; floor space, about 18 ft. by 19 ft. and approximate weight, 75,000 lb.

Multiple Punch Speeds Repairs to Steel Cars

The Louisville & Nashville recently modernized its South Louisville steel-car shop by relocating existing facilities and installing new equipment, which have made possible a shop capacity of 35 rebuilt cars per day. Among the



Punching 23 holes on one side of a hopper-car floor sheet in one operation with the Thomas 600-ton multiple punch

new equipment installed was the illustrated 600-ton multiple punch which is capable of punching four 1$\frac{1}{16}$-in. holes in 1-in. plate, or as many as 62 holes of $\frac{9}{16}$ in. diameter in $\frac{1}{4}$-in. plate at each stroke of the ram. Sheets up to 10 ft. 6 in. wide, 1 in. thick, and of any standard length can be worked with ease. The design of this machine is such that through the proper setting and manipulation of the punches, which are locked and unlocked with sliding keys, whole sheets requiring as many as 50 or 60 holes can be completely punched in from three to four strokes of the ram; whereas, with the old equipment used for this work the same sheets may have required from 50 to 60 strokes.

The multiple punch is 15 ft. 5 in. high and 15 ft. 6 in. wide. It has a ram length of 10 ft. 3 in. and is equipped with punching tools arranged in double rows with 50 separately adjustable punching units. It is operated by a 20-hp. 230-volt d. c. motor having automatic remote control.

The punch is predominantly a production machine and effects its greatest economy of operation when doing production work. The highest efficiency of operation is obtained when it is possible to handle successively as many as 100 or more sheets with identical perforations between die set-ups. Thus, the machine is arranged with its accompaniment of dies so grouped that the complete punching of each sheet is done with the least number of operations and the minimum of handling, the sheet being completed from start to finish and ready for application when leaving the punch. It has been used for punching rivet holes in floor sheets, end sheets, side sheets, hopper slope sheets, crossridge sheets, and longitudinal hoods. The multiple punch is made by the Thomas Machine Manufacturing Company, Pittsburgh, Pa.

Questions and Answers On the AB Brake

Brake Cylinders (Continued)

293—*Q.—Which connection on the test device should be attached to the brake-pipe hose on the car?* A.—The connection marked "BP".

294—*Q.—What should be done at the opposite end of the car under test?* A.—A dummy coupling should be placed in the hose and the angle cock opened.

295—*Q.—Why is this done?* A.—To include the air hose and fittings on that end of the car in the test.

296—*Q.—What next should be done?* A.—Open the angle cock on the end of the car at which the test device is connected, moving the test device handle to position No. 1 and charging the brake pipe and reservoirs to 70 lb.

297—*Q.—How long does it generally require to charge up a car?* A.—From 8 to 10 min.

298—*Q.—How may it be determined whether or not the reservoirs are charged to the brake-pipe pressure?* A.—Move the device handle to the lap position. If the brake-pipe pressure drops, the reservoirs are not charged.

299—*Q.—What is the first test to be made?* A.—The application test.

300—*Q.—How would you proceed to make this test?* A.—Lap the device handle for 5 sec. to determine if the equipment is fully charged, then move the handle to position No. 4. When the brake starts to apply, return to lap position.

301—*Q.—How much brake-pipe reduction should be required to obtain a brake application?* A.—Not more than 3 lb.

302—*Q.—After the device handle has been placed on lap, does the brake-pipe pressure remain constant?* A.—No. The pressure continues to drop until the quick-service limiting valve closes.

303—*Q.—What should be the total drop of brake-pipe pressure to accomplish this?* A.—The total drop should not be less than 4 lb.

High Spots in Railway Affairs . . .

Too Many Economic Illiterates

There is much misunderstanding in the railroad field about the wage question and its relationship to the welfare of both the workers and the stability of the railroad industry. With one-third of the railroads in bankruptcy and one-third more virtually bankrupt, the situation is exceedingly precarious. Dr. Harold G. Moulton of the Brookings Institution, recently made an address on technology and economic progress before the Engineering Society of Detroit. His closing words are worthy of careful and critical consideration. "In laying emphasis upon the need of reducing wage rates at the present juncture," he said, "I want to emphasize that this is the one means of expanding the weekly earnings of labor. We have to take our choice between high wage rates and prices, accomppanied by low aggregate wages and low volume of production, and lower wage rates and prices, accompanied by expanding production and expanding annual wages and profits. The simple truth is that wage rates, prices and productivity got seriously out of balance in 1937. The balance must be restored if we are again to go forward on a sound basis and on a broad economic front. Only by thorough-going readjustments in the wage-price equation shall we be able to proceed to the realization of the higher standards of living which are so urgently required."

A Reasonable Program

Congressman Samuel B. Pettengill, Democrat from Indiana, spoke at the May meeting of the New York Railroad Club on What's Ahead for the Railroads—The Future of the Iron Horse, prefacing his address with the statement that "For five years the Administration has done nothing about a thoroughly bad situation except to loan the railroads deeper into debt and provide them with more bankruptcy facilities." He made the following suggestions as to what should be done to give relief in the interests of both the railroads and the public:

Stop government competition. Sell the Federal Barge Line.

Stop subsidizing railroad competitors—at railroad expense.

Pass the Pettengill long and short haul bill.

When railroad facilities are required for the benefit of competitors let the cost follow the benefit.

Stop subsidizing intercoastal ships.

Don't pass the McAdoo bill to repeal tolls on American ships going through the Panama Canal.

Put all freight, mail and passenger rate making for all carriers under one body—railroads, trucks, pipeline, coastwise, intercoastal, Great Lakes and river shipping and aviation.

Restore railroad management to its constitutional freedom in strictly management problems.

Let the managements work out consolidation plans, leaving veto power with the I. C. C.

Repeal land grant contracts except during time of war.

Stop frightening investors with talk of repudiation of contracts in solvent roads.

Political Pressure

Incensed by the action of the railroads in starting the machinery to bring about a reduction in wages, several United States Senators have announced in loud tones that they will block the Wagner-Steagall R. F. C. rail loan bill unless the railroad managements withdraw from their wage reduction program. Incidentally these particular senators are among those that the newspaper, "Labor", has enshrined in its pages. That publication, always harsh in its criticism of the railroads because of what it claims to be over-capitalization, now apparently wants the railroads to go still further into debt in order to continue the payment of the prevailing high wage rates. As one independent commentator suggests, however, it will be folly to borrow money if it is to be expended for operating expenses, thus adding further to the fixed charges without improvement to the plant or equipment and the efficiency of operation. With Congress anxious for political reasons to adjourn at the earliest possible moment, there is apparently little possibility of the passage at this session of the Wagner-Steagall bill, or any worth while railroad legislation for that matter.

Pay Cut Notice Served

Employees of the railroads and the Railway Express Agency were notified on May 12 that the carriers proposed to make a 15 per cent reduction in their basic rates of pay. In 1932, when the railroads were in better financial condition than they are today, the employees voluntarily accepted a wage reduction. If the proposed 15 per cent reduction goes into effect, employees will still be getting more than they were after the reduction in 1932. Co-operation on the part of the employees at this time will, among other things, make it possible for the railroads to take care of some of the pressing equipment maintenance and repair work, which in turn will make possible the recalling to service of some of the furloughed employees. Otherwise, the prospects are for a long, drawn-out controversy, which will postpone aid being given to the railroads at this critical period and may engender much bad feeling. Data compiled by the Railway Age, as reported in an editorial in its issue of May 21, indicates that in 1930 labor received 65.8 per cent of the income, leaving 34.2 per cent for capital. In 1932 the division was, labor 72.3 per cent, and capital only 27.7 per cent. In 1937 labor got 70.8 per cent, leaving only 29.2 per cent to capital. "On the basis of results thus far," says the Railway Age, "labor will receive in 1938 relatively much more and capital much less of what will be available for division than in any other year in the entire history of railroading in the United States."

The railways can't operate and provide jobs without a constant inflow of new capital—and new capital won't come in unless capital already invested gets a fairer share of railway earnings than it is getting now. Good money won't go after bad.

It is a condition and not a theory that railway labor is facing. The question is not how much capital *ought* to get. Rather the question is how much capital has got to be paid to induce it into railroad investment. Unless railway labor agrees to allow capital the minimum earnings which will attract it, capital will stay out of the railroads. And when capital stays out, jobs decline.

The unions can take their choice. They can take so much in wages that capital stays out of the railroads—and jobs will decline. Or they can concede capital a "minimum wage," and money will pour into the railroads and railway employment will increase.

Neglected Step-children

With all its other confusing problems Congress has given little constructive attention during the past month to the plight of the railroads. Considering the seriousness of the railway situation, our solons appear to have been fiddling while Rome was burning. The New York Sun in one of its editorials sized up the situation in these words: "As a matter of simple arithmetic, it must be plain that if the railroads and the electrical utility companies could be put into position to catch up with their arrears of construction, repairs and replacements, there would be little cause for the government to worry about pump priming. But these industries are step-children of current politics; they will get scant consideration so long as a squabbling horde of demagogues can exploit them for vote-catching purposes."

(Turn to next left-hand page)

*Photographed by W. R. McGee, Livingston, Mont.**

NEWS

R. F. C. Loans

THE Southern has applied to the Reconstruction Finance Corporation for a loan of $14,000,000, the proceeds to be used to purchase "approximately four Diesel-electric or gasoline passenger trains of one or two units each and approximately 5,000 freight train cars." The petition states that the cost of the trains will be $500,000 and the cost of the cars $13,500,000.

Equipment Repair Programs

The Wabash has been authorized by the federal district court at St. Louis to spend $176,700 for general repairs and the application of non-harmonic truck springs to 300 box cars.

The Missouri Pacific will repair 300 fifty-ton box cars at its De Soto, Mo., shops, and upon their completion in August will begin the construction of 100 flat cars.

Locomotives Make High Mileages on "Olympian"

THREE of the new 4-8-4 type combined freight and passenger locomotives delivered early in the year to the Chicago, Milwaukee, St. Paul & Pacific by the Baldwin Locomotive Works have been assigned to handle the Olympian trains of that railroad between Minneapolis, Minn., and Harlowton, Mont., where steam terminates and electric territory begins. Each locomotive makes the entire run between the two terminals, a distance of 1,835 miles per round trip. The three locomotives on this assignment, Nos. 218, 219 and 224, accumulated a total of 55,083 miles during the month of March, or an average of 18,361 miles per locomotive per month.

Locomotive No. 224 made its break-in trip in freight service on February 11, 1938, and during the month of March accumulated 19,282 miles in passenger service between the stations mentioned. Under present operating conditions this is the maximum mileage possible to obtain through this territory on the Milwaukee due to a bridge restriction at Minneapolis and the end of steam-operated territory at Harlowton.

On the east end of the run the locomotives have a layover period of 11 hrs. 15 min., as compared to 18 hrs. 21 min. on the west end. These relatively long layovers are due primarily to the train schedules. Locomotives assigned to this run are handled by six different crews in each direction and no unusual attention is given to them en route. The servicing which the locomotives receive at certain designated stations is practically the same as that required by the 4-6-4 type locomotives previously assigned to handle Olympian trains through this territory.

Mechanical Division Publications

REVISED loose-leaf pages for the Manual of Standard and Recommended Practice of the Association of American Railroads, Mechanical Division, are now available for distribution at nominal cost on application to Secretary V. K. Hawthorne. The 1937 Annual Meeting Proceedings will also be ready for distribution in a short time.

Secretary Hawthorne has been authorized to dispose of the few remaining copies of the report of the Mechanical Advisory Committee to the Federal Co-ordinator of Transportation, issued in 1936. Other reports which may be secured from the secretary include the following: Comparative Impact Tests of Pullman Light-weight Box Car of 1937 and A. A. R. Standard Box Car of 1932; Final Report of Tests of Trucks and Truck Springs; Engineering Report on Air-Conditioning of Railroad Passenger Cars; Report of Road Performance of Air-Conditioned Pullman Sleeping Cars; Report on Relative Performance of Air Filters; and Summary Report on Impact Tests of Light-weight Box Cars.

Equipment Depreciation Rates

EQUIPMENT depreciation rates for seven railroads, including the Detroit, Toledo & Ironton and the Pere Marquette, are prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15100, Depreciation Charges of Steam Railroad Companies. The composite percentages, which are not prescribed rates but merely derivatives of such, for six of the roads are: Kentucky & Tennessee, 3.05 per cent; D. T. & I., 4.13 per cent; Pere Marquette, 4.17 per cent; Ashley, Drew & Northern, 5.66 per cent; Northampton & Bath, 4.26 per cent; El Dorado & Wesson, 13.59 per cent.

The sub-order relating to the D. T. & I., a modification of a previous sub-order, prescribes rates as follows: Steam locomotives—new, 3.08 per cent; steam locomotives—secondhand or rebuilt, 6.03 per cent; freight cars—new, 3.59 per cent; freight cars—secondhand or rebuilt, 4.12 per cent; passenger-train cars, 5.1 per cent; work equipment, 3.5 per cent; miscellaneous equipment, 16.44 per cent.

The Pere Marquette figure is derived from the following prescribed rates: Steam locomotives—new, 3.42 per cent; steam

(*Continued on next left-hand page*)

* The third section of train No. 1 on the Northern Pacific westbound on the 1.8 per cent grade three miles west of Livingston, Mont. The train consists of ten cars and is hauled by locomotive No. 5108, a 4-6-6-4 type. The photograph was taken on June 14, 1937. The photographer is a Northern Pacific brakeman.

locomotives—secondhand, 4.31 per cent; freight-train cars, 4.5 per cent; passenger-train cars—new all-steel, 3 per cent; other all-steel passenger-train cars, 4 per cent; air-conditioning equipment, 5.42 per cent; floating equipment, 3.21 per cent; work equipment—owned, 3.99 per cent; work equipment—leased, 4.52 per cent; miscellaneous equipment, 10.86 per cent.

Semi-Annual Meeting of A.S.M.E. To Be Held at St. Louis

TECHNICAL sessions of the semi-annual meeting of the American Society of Mechanical Engineers, to be held at the Statler Hotel, St. Louis, Mo., June 20-23, will begin Monday evening, June 20, and continue through Thursday morning. At the luncheon meeting on Tuesday, June 21, Raymond R. Tucker, commissioner of smoke regulation of St. Louis, will tell something of the past, present and future of smoke abatement in St. Louis, and the fourth Calvin W. Rice lecture on Some Metallurgical Contributions to Engineering Progress will be presented by William Robb Barclay, at 4:15 p. m., on the same day. The program contains the following papers of interest to railroad men:

TUESDAY, JUNE 21

Morning

Railroad

Locomotive Axle Testing, by T. V. Buckwalter, vice-president, O. J. Horger, research engineer, and W. C. Sanders, general manager, Railway Division, The Timken Roller Bearing Company.

The Drafting of Steam Locomotives, by J. R. Jackson, engineer of tests, Missouri Pacific.

Noon

Smoke Abatement Luncheon

Afternoon

Railroad

An Oil-Bath-Lubricated Railway Bearing, by Albert Vigne, vice-president, charge of operations, and I. Eugene Cox, research engineer, National Bearing Metals Corp.

Influence of Pressure on Film Viscosity in Heavily Loaded Bearings, by S. J. Needs, research engineer, Kingsbury Machine Works, Inc.

WEDNESDAY, JUNE 22

Morning

Apprenticeship

An Apprenticeship Training Program, by H. L. Humke.

Welding and Flame-Cutting

Oxyacetylene Surface Hardening, by A. K. Seemann, Linde Air Products Co.

Arc-Welding Costs, by E. W. P. Smith, consulting engineer, The Lincoln Electric Co., Cleveland.

$509,793,000 Capital Outlay in 1937

CAPITAL expenditures for equipment and other improvements to railway property made by the Class I railroads in 1937 totaled $509,793,000, according to the Association of American Railroads. This was an increase of $210,802,000 above such expenditures in 1936, but a decrease of $362,815,000 compared with those in 1930.

The increase over 1936 was largely due to heavier orders for new equipment placed by the railroads in the first half of 1937 when indications pointed to a substantial volume of traffic. Due to the decrease in traffic and earnings which developed in the latter months of the year, and the resulting serious financial condition of the railroads, however, there was a marked decline in equipment orders and capital improvements. This situation continues to exist.

Of the total capital expenditures made in 1937, $322,877,000 was for locomotives, freight and passenger train cars, and other equipment, and $186,916,000 was for roadway and structures. In 1936, capital expenditures for equipment amounted to $159,104,000, and for roadway and structures, $139,887,000.

Expenditures for locomotives in the past calendar year totaled $59,738,000, compared with $16,209,000 in the preceding year. For freight train cars, $212,902,000 was expended, an increase of $95,000,000 above such expenditures in 1936, while for passenger train cars, $41,491,000 was expended, which was approximately twice the amount spent for that purpose in the previous year. For other equipment, the railroads in 1937 expended $8,746,000.

Western Railway Club Elects Officers

AT the annual meeting of the Western Railway Club on Monday evening, May 16, at the Hotel Sherman, Chicago, a brief business session was held, just preceding the main address of Clarence F. Lea, national congressman from California, for the consideration of business reports and the election of new officers. The report of the secretary showed a total membership, as of April 22, 1938, of 1,961, including 955 railroad and 912 supply company representatives.

The following officers were elected for the ensuing year: President, E. A. Clifford, general purchasing agent, Chicago & North Western; first vice-president, H. H. Urbach, mechanical assistant to executive vice-president, Chicago, Burlington & Quincy; second vice-president, O. N. Harstad, general manager, Chicago, Milwaukee, St. Paul & Pacific; and treasurer, J. W. Fogg, vice-president and general manager, MacLean-Fogg Lock Nut Company.

Employment Drop Continues

RAILWAY employment fell off another 1.54 per cent during the one-month period from mid-March to mid-April, according to the Interstate Commerce Commission's compilation, based on preliminary reports. The drop as compared with April, 1937, was 19.27 per cent.

The total number of employees as of the middle of April was 913,070 as compared with a mid-March figure of 927,308. In only one group was there an increase over the previous month—maintenance of way and structures forces were up 2.57 per cent, although they were 25.67 per cent under April, 1937. The largest drop as compared with mid-March was in the maintenance of equipment and stores group, which fell off 3.63 per cent; and was down 28.25 per cent from April, 1937. The index number, based on the 1923-1925 average as 100 and corrected for seasonal variation, stood at 51.5 in April, as compared with 53.4 in March and 63.8 in April, 1937.

New Equipment Orders and Inquiries Announced Since the Closing of the May Issue

LOCOMOTIVE ORDERS

Company	No. of Locos.	Type of Loco.	Builder
Boston & Maine	1	600-hp. Diesel-Elec. switcher	Alco
	1	250-hp. gas.-mech. locomotive	Plymouth Locomotive Works
Grand Trunk Western	2	600-hp. Diesel-Elec.[1]	Electro-Motive Corp.
Portland Terminal Co.	1	600-hp. Diesel-Elec. switcher	Alco
Warrior River Terminal	1	900-hp. Diesel-Elec.	Alco

LOCOMOTIVE INQUIRIES

Akron, Canton & Youngstown	3-4	2-8-2	....
St. Louis & Belleville	2	Electric	....

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Brazilian Portland Cement Co.	20	10-ton hopper	Magor Car Corp.
Chicago, Milwaukee, St. Paul & Pacific	464	Flat[2]	Company shop
Southern Railway	2,000	40-ton box	Pullman-Standard Car Mfg. Co.
	1,000	40-ton box	Mt. Vernon
	200	50-ton furniture	Mt. Vernon
	50	70-ton M. T. gondola	Mt. Vernon
	1,250	50-ton H. S. gondola	American Car and Foundry Co.
	700	50-ton L. S. gondola	Pressed Steel
	250	40-ton stock	Ralston Steel
	100	70-ton flat	Greenville Steel
United Fruit Company	10	7,500-gal. tank[3]	Magor Car Corp.

FREIGHT-CAR INQUIRIES

American Smelting & Refining Co.	30	40-ton box[4]	....
Semet-Solvay Company	10	70-ton hopper	....

PASSENGER-CAR ORDERS

Road	No. of Cars.	Type of Car	Builder
Chicago, Milwaukee, St. Paul & Pacific[2]	55		Company shop
Missouri & North Arkansas	2	Pass.-bagg.-exp. rail motor cars[5]	American Car and Foundry Co.

PASSENGER-CAR INQUIRIES

Seaboard Air Line	6	Lightweight coaches	....
	4	Lightweight baggage & mail cars	....

[1] One-hundred ton, eight-cylinder locomotive, for use at Brush Street Terminal, Detroit, Mich.

[2] Material for the 55 passenger cars and the 464 flat cars is now being fabricated. These orders are part of its equipment program to cost $3,000,000, which also includes the purchase of four passenger locomotives, as was noted in the March issue of the *Railway Mechanical Engineer.*

[3] For service in Guatemala.

[4] For service in Mexico.

[5] To be 75 ft. 7 in. in length, with a seating capacity of 32 passengers.

Supply Trade Notes

F. J. DOLAN has been appointed assistant to vice-president of The Superheater Company, with headquarters at New York.

NORMAN C. NAYLOR, vice-president of the American Locomotive Company at Chicago, has been elected also a director.

THE DAYTON RUBBER MANUFACTURING COMPANY, Dayton, Ohio, now has its Chicago office in the Merchandise Mart building, Chicago.

R. J. SCHULER has been appointed general sales representative of the Union Drawn Steel Division of the Republic Steel Corporation, Cleveland, Ohio.

N. B. ROBBINS has been appointed representative of the Hunt-Spiller Manufacturing Corporation, Boston, Mass., to fill the vacancy caused by the death of R. R. Wells.

THE DUFF-NORTON MANUFACTURING COMPANY, Pittsburgh, Pa., has moved its New York sales office from 250 Park avenue to the Empire State building.

J. T. LUSIGNAN, JR., engineering assistant to the vice-president of The Ohio Brass Company, Mansfield, Ohio, has been appointed executive engineer. Mr. Lusignan will supervise all engineering activities of the company.

DAN W. HIRTLE, vice-president of the Burgess Battery Company with headquarters at Chicago, has been elected president to succeed C. F. Burgess, who has been elected chairman of the board of directors.

E. T. CROSS, eastern manager of the Ingot Iron Railway Products Company, Middletown, Ohio, with headquarters at Philadelphia, Pa., has been promoted to general manager, with headquarters at Middletown.

W. R. SPILLER has become affiliated with the Timken-Detroit Axle Company, Detroit, Mich., as sales engineer. Mr. Spiller was chief engineer of the White Motor Company, Cleveland, Ohio, previous to his new appointment with the Timken-Detroit Axle Company.

LEE F. ADAMS, formerly associated with the commercial general department of the General Electric Company, Schenectady, N. Y., has been appointed manager of the company's newly-formed standards department. Mr. Adams will also act as assistant to vice-president E. O. Shreve.

W. E. BETTENDORF, secretary of the Bettendorf Company, Bettendorf, Iowa, has been elected vice-president and general manager, and C. J. W. Clasen, assistant manager of sales, has been appointed sales manager.

B. J. HERRON, for the past 12 years, general representative in the western section for the Independent Pneumatic Tool Company, Chicago, has been placed in charge of a new sales-service branch at 6200 E. Slauson avenue, Los Angeles, Cal.

J. L. NOON, general railway sales manager of the Glidden Company, Cleveland, Ohio, has been appointed manager of its industrial and transportation sales in the United States and Canada, with his headquarters as formerly, at Cleveland.

WILLIAM S. RICHARDSON, merchandising manager of the B. F. Goodrich Company, Akron, Ohio, in its mechanical goods division since 1931, has been appointed general sales manager of the same division, succeeding C. E. Cook, deceased.

C. P. WHITEHEAD, manager of sales of the General Steel Castings Corporation, Eddystone, Pa., has been elected vice-president in charge of sales, and E. G. Hallquist, chief mechanical engineer, has been elected vice-president in charge of engineering.

THE STEEL AND TUBE DIVISION of the Timken Roller Bearing Company, Canton, Ohio, has appointed Joseph T. Ryerson & Son, Inc., Chicago, to warehouse Timken mechanical tubing in territories served by Boston, Mass., Jersey City, N. J., Philadelphia, Pa., Buffalo, N. Y., Cincinnati, Ohio, Chicago, St. Louis, Mo., Cleveland, Ohio, Detroit, Mich., and Milwaukee, Wis.

THE REPUBLIC STEEL CORPORATION, Cleveland, Ohio, has appointed the American Wholesale Hardware Co., Long Beach, Cal.; the Anderson Supply Co., Norwich, Conn.; and the Valley Supply Co., Springfield, Mass., jobbers for its tubular products and Herre Brothers, Harrisburg, Pa., and the Sabine Supply Co., Orange, Tex., distributors for its iron sheets.

THE CELOTEX CORPORATION, Chicago, has acquired full rights to manufacture and sell Pottsco lightweight aggregate, which is made under a patented process by water treatment from molten basic pig-iron slag. Harry H. Potts, president of the Pottsco Corporation, will serve as manager of the Pottsco department of the Celotex Corporation. Production facilities will be maintained at Chicago; Youngstown, Ohio; Buffalo, N. Y., and Troy; and Pittsburgh, Pa., and Birdsboro.

CHARLES L. BROWN, western sales manager of the Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., New York, retired on May 1, at his own request, after 32 years of service. Mr. Brown began work with Manning, Maxwell & Moore, in Chicago, on July 1, 1906, as the company's only representative for the west and mid-west. Under his guidance, a sales organization was developed for this section, and he became western sales manager. Robert Watson succeeds Mr. Brown as western sales manager of the Locomotive Equipment Division, with office in the Field building, Chicago. Mr. Watson was formerly with the Waugh Equipment Company, the Erie railroad and the American Locomotive Company.

WILLIAM P. ANDREWS, assistant manager of sales in the Chicago district of the Carnegie-Illinois Steel Corporation, has been appointed manager of sales of the Cincinnati district, succeeding Lawrence K. Slaback, deceased. T. Lane Watson, who has been in charge of the bar strip and semi-finished materials division of the Carnegie-Illinois Steel Corporation at Chicago, succeeds Mr. Andrews as assistant manager of sales of the Chicago district.

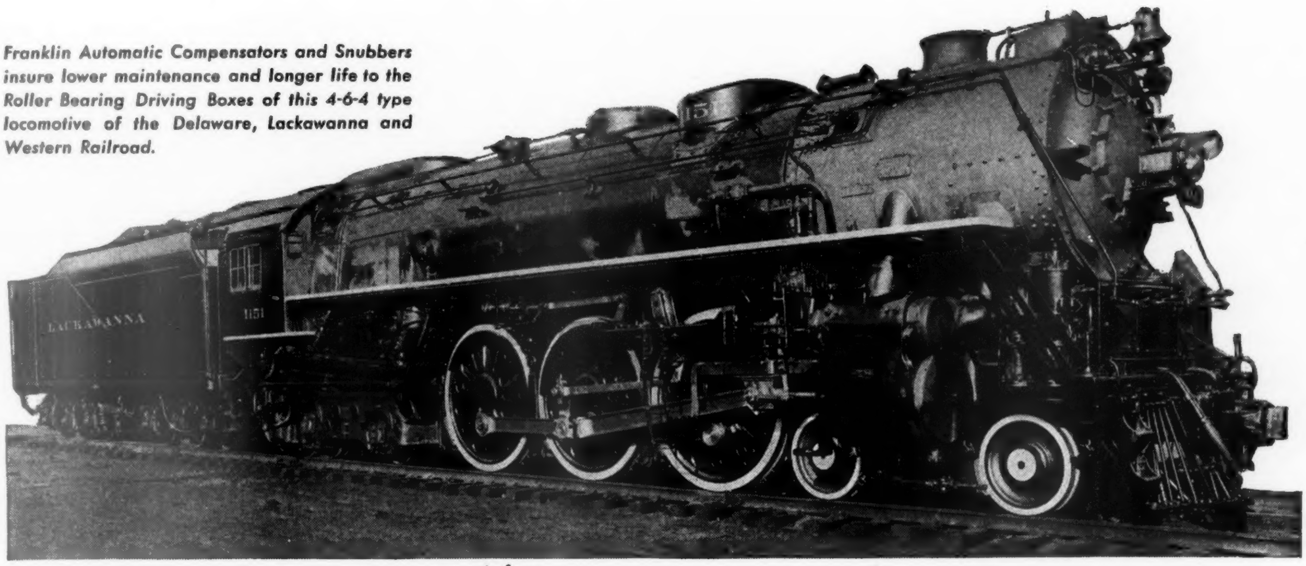
CHARLES B. ROSE, acting works manager of the Baldwin Locomotive Works, at Eddystone, Pa., has been elected a vice-president, and Charles D. MacGillivray, secretary, has been elected a vice-president with headquarters at Eddystone. Walter E. Seymour has been appointed works manager of the Locomotive Division succeeding Charles B. Rose. Mr. MacGillivray will continue also as secretary.

HENRY W. COLLINS, New York sales division manager of the Celotex Corporation, has been elected vice-president and has been succeeded by Harry W. Conway, assistant manager of that division. J. Z. Hollman, assistant general sales manager, has been promoted to general sales manager. Mr. Hollman, who was born in 1896, has been with the Celotex Corporation since 1926. He was formerly branch manager of the St. Louis sales division, and was appointed assistant general sales manager on November 1, 1936. He is a graduate of Washington State College, Pullman, Wash.

W. ROY WIDDOES, assistant to the president of the By-Products Steel Corporation, Coatesville, Pa., has been appointed general manager of the organization. Mr. Widdoes was born in January, 1895, at Coatesville, and there attended high school. He joined the Lukens Steel Company in 1912, as a clerk. Three years later he went with the Reading Company, but re-

(Continued on second left-hand page)

Franklin Automatic Compensators and Snubbers insure lower maintenance and longer life to the Roller Bearing Driving Boxes of this 4-6-4 type locomotive of the Delaware, Lackawanna and Western Railroad.



POUND is eliminated in these ROLLER BEARING DRIVING BOXES

Roller Bearing Driving Boxes require that the exact initial tolerances be constantly maintained, allowing only a few thousandths deviation for running temperature. The Franklin Automatic Compensator and Snubber is designed to take up automatically any expansion and contraction that occurs in the driving box . . . while the locomotive is running at road-speed. In addition, a heavy spring acts as a cushion to take care of any abnormal shocks. » » » For lower maintenance, easier riding, prevention of pounds, and reduced tire wear, investigate the Franklin Automatic Compensator and Snubber.

FRANKLIN AUTOMATIC COMPENSATOR AND SNUBBER

SUPPLY COMPANY, INC.

CHICAGO MONTREAL

turned to the Lukens Steel Company the same year to serve in its purchasing department. In 1929 he was appointed assistant purchasing agent and in May, 1937, joined the By-Products Steel Corporation as assistant to president.

◆

PERCY T. OLDHAM has been appointed manager of special sales for the By-Products Steel Corporation, division of Lukens Steel Company, Coatesville, Pa. Mr. Oldham was born in Wheeling, W. Va., in September, 1890. He received his education there and was first employed as assistant county surveyor of Belmont County, Ohio. He was later field engineer of the Wheeling Corrugating Company and the Whittaker Glessner Company at the

P. T. Oldham

Wheeling and Martins Ferry, Ohio, plants, both of which are now a part of the Wheeling Steel Corporation. In 1912 Mr. Oldham became supervising engineer of S. Diescher & Sons, consulting engineers, Pittsburgh, Pa. In December, 1915, he joined the Lukens Steel Company, serving as assistant construction engineer until 1925 when he was transferred to the sales department as manager of flanging sales. Several years later he became engaged in special sales work, in which he remained until his appointment as manager of special sales for the By-Products Steel Corporation. Mr. Oldham is a member of the American Society of Mechanical Engineers and of the Engineers Club of Philadelphia.

◆

A. D. PRENDERGAST, formerly lubrication engineer of the Texas Company, Railway Sales Division, with headquarters at Kansas City, Mo., has been transferred to St. Paul, Minn., as representative of the Railway Sales Division, to succeed A. W. Larsen, who has been appointed assistant district manager, with headquarters at St. Louis, Mo.

◆

J. B. TYTUS has been elected vice-president in charge of operations of the American Rolling Mill Company, Middletown, Ohio, and Frank H. Fanning has been appointed assistant vice-president in charge of operations. Mr. Tytus joined the Armco organization in 1904. He was awarded the Gary medal by the American Iron and Steel Institute several years ago for his part in the development of the continuous rolling process in the manufacture of Iron and steel sheets; and was elected vice-president of Armco in charge of processing developments in 1927. Mr. Fanning entered the organization in 1909 and was associated with Mr. Tytus in 1912 at the Armco mill at Middletown; he later served on numerous special assignments and was appointed assistant to the executive vice-president in 1933.

◆

L. W. MARTIN, of the sales department of the American Car and Foundry Company, has been appointed district sales manager, with headquarters at St. Louis, Mo. Mr. Martin graduated in 1902 from the State University of Kentucky, as bachelor of mechanical and electrical engineering. In the same year he entered the St. Charles, Mo., car shops of the American Car and Foundry Company, where for two years he was engaged in various departmental work. In 1904 he was transferred to St. Louis, and was engaged in engineering, drafting, estimating and de-

L. W. Martin

signing work. His thesis on train lighting obtained for him in 1906 master degree of mechanical engineering at Kentucky University. In 1907 he joined the St. Louis sales office as sales agent for railroad equipment throughout the South. Shortly after the outbreak of the World War, he was transferred to the American Car and Foundry Export Company, a subsidiary of the American Car and Foundry Company. As foreign representative, he traveled in Russia, Siberia, Italy and China on work for the railways of these countries. He returned in 1920 to the American Car and Foundry Company, and resumed sales work. In his new position, Mr. Martin will be in charge of all sales activities under the jurisdiction of the St. Louis office.

Personal Mention

General

ALEX B. COLVILLE, who has been appointed superintendent of motive power of the Great Northern, with headquarters at Spokane, Wash., as noted in May, was born in Scotland on December 22, 1883. He began railway service with the Great Northern on October 25, 1898, as a boilermaker apprentice at Spokane, becoming a machinist apprentice a year later and advancing to machinist in October, 1903. He was made shop foreman of the Hillyard (Wash.) shops in June, 1907, but left the Great Northern in October, 1915, to become general foreman on the Spokane, Portland & Seattle (controlled jointly by the Great Northern and the Northern Pacific) at Portland, Ore. On September 1, 1917, Mr. Colville returned to the Hillyard shops of the Great Northern as general foreman, and on March 1, 1935, was appointed to the position of superintendent of shops at Hillyard which he was holding at the time of his appointment as superintendent of motive power at Spokane.

C. L. WILSON, master mechanic of the Elgin, Joliet & Eastern at Joliet, Ill., has

C. L. Wilson

been appointed superintendent of motive power, succeeding J. C. Shreeve, who has retired. Mr. Wilson was born at Joliet, Ill. He entered railway service on November 25, 1897, as a machinist helper on the Elgin, Joliet & Eastern. On March 3, 1898, he became a locomotive fireman, and on January 8, 1903, was promoted to locomotive engineer. He was appointed assistant train rule examiner on September 21, 1918, and traveling engineer on February 1, 1919. Mr. Wilson was appointed air brake supervisor on January 15, 1925, and on August 1, 1933, he was promoted to master mechanic at Joliet, which position he held until his recent promotion.

J. P. MORRIS, who has been appointed mechanical superintendent of the Eastern mechanical district of the Eastern lines of the Atchison, Topeka & Santa Fe at Shopton, Iowa, as noted in the May issue, has

(Continued on next left-hand page)

ANYTHING

less than a complete arch

IS FALSE ECONOMY

To let the desire for reduced inventory result in a locomotive leaving any roundhouse without a full set of Arch Brick is poor economy. » » » Even a single missing Arch Brick will soon waste many times its cost in fuel and in locomotive efficiency. » » » To spend the fuel dollar efficiently, every locomotive Arch must be maintained 100%. » » » Be sure your stocks on hand are ample to provide fully for all locomotive requirements, so that locomotive efficiency may be maintained.

There's More to SECURITY ARCHES Than Just Brick

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

been identified with the mechanical department of the Santa Fe continuously for 34 years. He was born on March 4, 1889, at Fort Madison, Iowa, and entered the service of the Santa Fe in 1904, as a laborer at that point. Subsequently he served as a machinist and gang foreman, being promoted to enginehouse foreman in 1917. Six years later he became general foreman and in 1924 he was appointed master mechanic with headquarters at Chicago. On July 1, 1937, he became mechanical assistant in the general office at Chicago.

J. P. Morris

G. T. Strong, assistant superintendent motive power of the Virginian, with headquarters at Princeton, W. Va., has been appointed superintendent motive power, with the same headquarters.

Master Mechanics and Road Foremen

Charles Jacob Gerbes, who has been appointed master mechanic of the Erie at Marion, Ohio, as noted in the April issue, was born on November 24, 1892, at Hawthorne, N. J. He attended high school for one year and then took the supervisor's training course of the Railway Educational Bureau. He entered the service of the Erie on November 15, 1911, as a machinist at Secaucus, N. J., becoming machine shop foreman on October 1, 1914, enginehouse foreman on February 1, 1916, and general enginehouse foreman on April 1, 1918. On February 1, 1924, he went to Hornell, N. Y., as general foreman in the back shop, and on December 1, 1927, was appointed master mechanic at Hornell. Mr. Gerbes returned to Secaucus on November 7, 1930, as master mechanic; on July 1, 1932, became master mechanic at Avoca, and on March 1, 1938, was transferred to Marion.

Charles Jacob Gerbes

Charles W. Ecenbarger, who has been appointed master mechanic of the Erie at Avoca, Pa., as noted in the April issue of the *Railway Mechanical Engineer,* was born on May 17, 1888, at Huntington, Ind. He received his education at common and high schools and entered the service of the Erie on September 1, 1907, as a machinist apprentice at Huntington. Upon the completion of his apprenticeship in 1911 he served in the back shop for a period of two years and in the enginehouse for one year. In 1915 he became night enginehouse foreman; in 1918, day enginehouse foreman, and in 1919, general enginehouse foreman. From December, 1922, until May, 1928, he was night general foreman at Marion, Ohio. He was transferred to Port Jervis, N. Y., on December 1, 1930, as general foreman, and on March 1, 1938, was appointed master mechanic at Avoca.

Henry M. Sherrard, who has been appointed master mechanic of the Baltimore & Ohio, with headquarters at Grafton, W. Va., as noted in the March issue of the *Railway Mechanical Engineer,* was born on April 28, 1888. He attended grade and high schools and entered railroad service on March 3, 1903, as a messenger in the office of the superintendent of motive power office of the B. & O. In April of the same year, Mr. Sherrard became a machinist apprentice. From 1907 to 1915 he was a machinist at Newark, Ohio. He was piece work inspector at Newark for a period of one year, and in 1916 became assistant machine shop foreman. In 1918 he became machine shop and general foreman and in 1925 was transferred to Glenwood (Pittsburgh), Pa., as general machine shop foreman. In May, 1930, he became motive power inspector of the Western Lines and on December 21, 1937, was appointed master mechanic at Grafton.

Henry M. Sherrard

Car Department

Thomas Bell has been appointed acting night car foreman at the Ocean Terminals (Halifax, N. S.) of the Canadian National.

Joseph E. Harlen, night car foreman of the Canadian National at the Ocean Terminals, Halifax, N. S., has been appointed acting day car foreman.

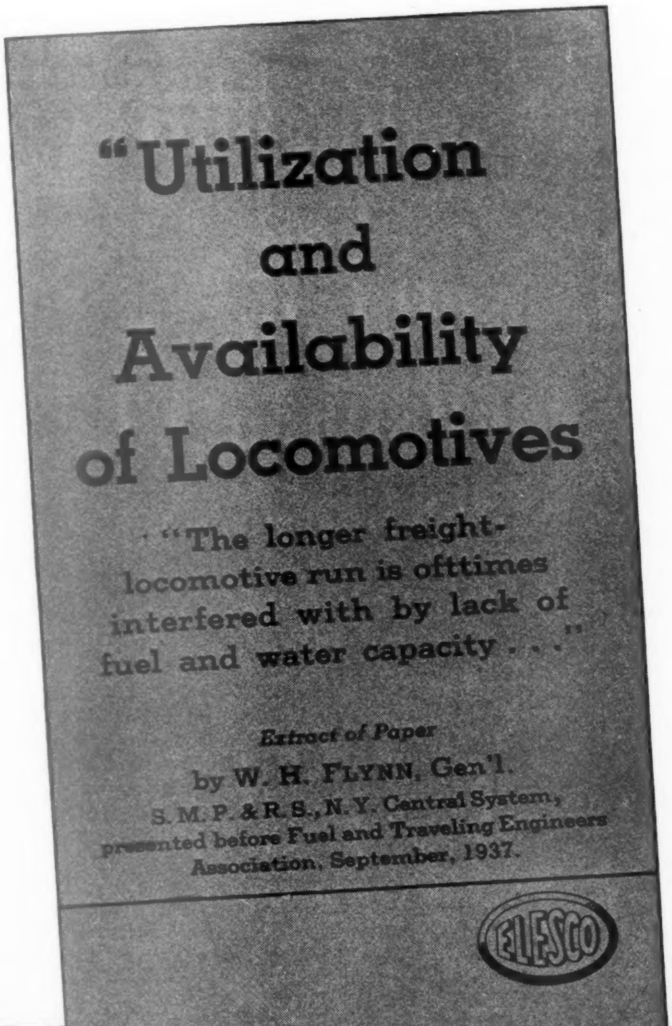
P. H. Mitchell, who has been appointed master car builder of the Delaware, Lackawanna & Western at Scranton, Pa., succeeding E. M. Jenkins, retired, was born at Prescott, Ark. He entered railroad service as a car repairman with the Prescott & North-western and subsequently was employed as a car foreman on the Memphis, Dallas & Gulf (now part of the Graysonia, Nashville & Ashdown and the Murfreesboro-Nashville) at Nashville, Ark. Leaving that company Mr. Mitchell entered the employ of the San Antonio, Uvalde & Gulf as air brake inspector and steam heat supervisor, later returning to the Memphis, Dallas & Gulf as master car builder. He was general car inspector of the Texas & Pacific, at Dallas, Tex., prior to entering the service of the Delaware, Lackawanna & Western two years ago, and until his appointment as master car builder, had been general car inspector at Scranton.

P. H. Mitchell

W. A. Emerson, master car builder on the Elgin, Joliet & Eastern at Joliet, Ill., has been promoted to the newly created position of general master car builder, with jurisdiction extended to cover the Gary division, and with headquarters as before at Joliet. The office of master car builder at Joliet is abolished.

A. A. Burkhard, superintendent of shops of the Merchants Despatch Transportation Corporation, at East Rochester, N. Y., who has retired from active service, as noted in the May issue, began his career in the car department of the Pittsburgh & Lake Erie at Pittsburgh, Pa., in April, 1884, as a messenger and office boy. He later served consecutively as car builder apprentice in the shops at McKees Rocks, Pa., then in various departments of the shops, as mechanic and inspector and as division general foreman at Glass-

(Continued on next left-hand page)



Ample fuel and water capacities are essential for long locomotive runs.

For existing power especially, these capacities can be increased by virtue of the economy resulting from the reclamation of waste heat in exhaust steam through the medium of the Elesco exhaust steam injector.

At a very nominal charge—these injectors can be installed—to provide for both economy and longer runs.

THE
SUPERHEATER
COMPANY

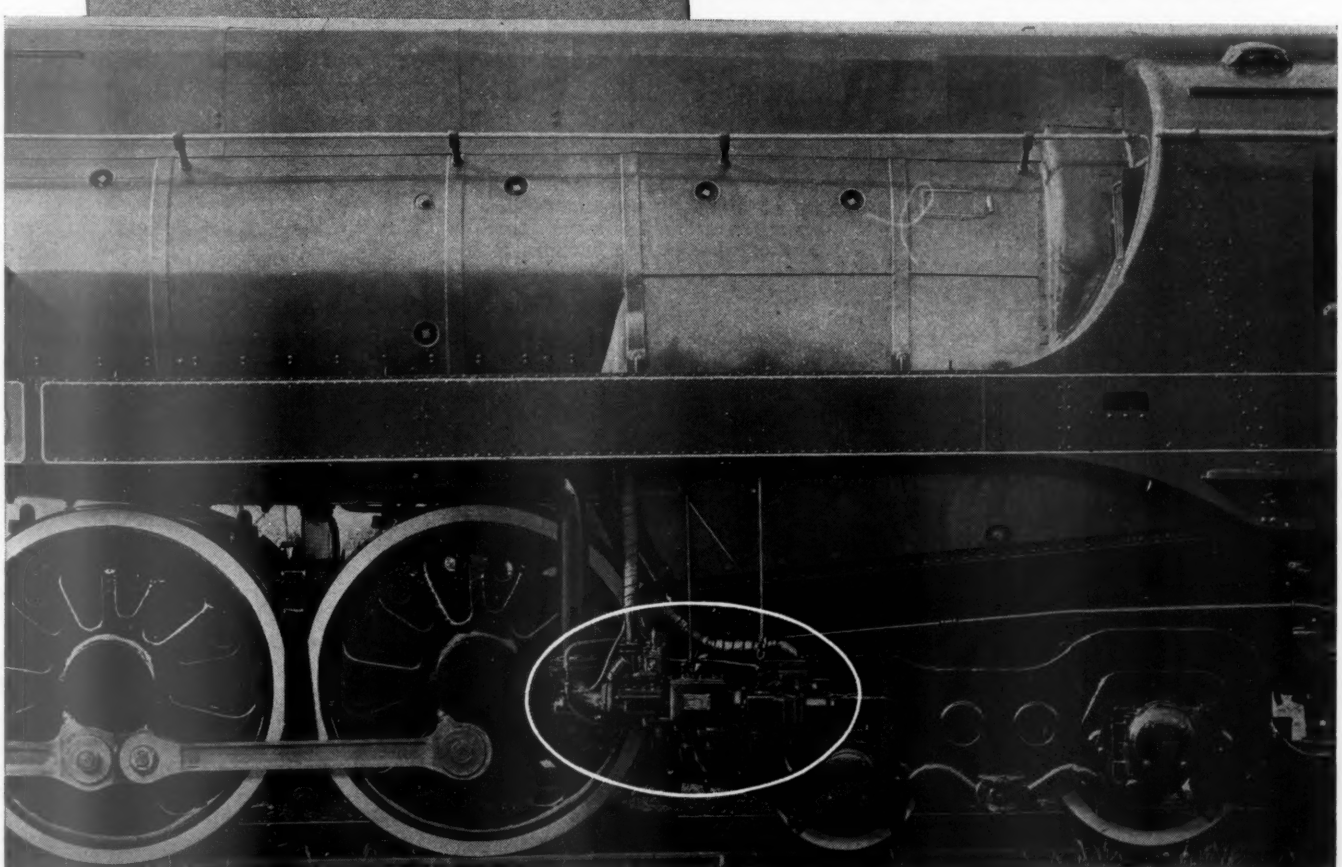
Representative of American Throttle Company, Inc.

60 East 42nd Street **122 S. Michigan Ave.**
NEW YORK **CHICAGO**

A-1236

Canada: The Superheater Company, Ltd., Montreal

Superheaters • Feed Water Heaters • American Throttles
Exhaust Steam Injectors • Pyrometers • Steam Dryers



port, Pa. In 1908 he was transferred to the West Albany, N. Y., shops of the New York Central as assistant general foreman; in February, 1916, he was promoted to general foreman, and in May, 1920 became division general foreman. Mr. Burkhard was transferred to Selkirk, N. Y., in March, 1925, and in August, 1930, went to the East Rochester shops of Merchants Despatch as superintendent of shops.

Obituary

GEORGE W. BEBOUT, electrical and shop engineer on the Chesapeake & Ohio died on May 10. Born at Parkersburg, W. Va., on May 18, 1874, Mr. Bebout received his

George W. Bebout

secondary education at the Greenbrier Seminary and, subsequently, the Allegheny Collegiate Institute, where he specialized in electrical engineering and power plants. In 1894 he entered the service of the Richmond Railway & Electric Company, where he served for four years in various capacities. Following this, he was employed by the Chesapeake & Ohio in shop service for a few months, after which he went with the Richmond Locomotive Works (now the American Locomotive Works). Here, he was promoted from foreman of the electrical department to electrical engineer of the American Locomotive Company, to succeed E. M. Archibald. Later Mr. Bebout also took over the duties of shop engineer as well, with the title of electrical and shop engineer, serving in this capacity until 1912, when he entered the service of the Chesapeake & Ohio, in the capacity which he held at the time of his death. He was president of the Association of Railway Electrical Engineers, 1932-33.

JOHN J. CONN, general purchasing agent for the Atchison, Topeka & Santa Fe, with headquarters in Chicago, died at his home in Oak Park, Ill., on April 28.

WILLIAM A. MCCAFFERTY, master mechanic in charge of the Columbus, Ga., shops of the Central of Georgia, died suddenly at his home in that city on April 21, following a heart attack.

GEORGE E. SMART, who retired in June, 1932, as chief of car equipment of the Canadian National, died on April 25, at his home in Montreal, Que. Mr. Smart was born in Edinburgh, Scotland, on December 23, 1873, and began railroad service in 1892, in the car department of the Grand Trunk. He was with the Canadian Pacific from 1904 to 1913, holding successively the positions of general inspector, heating and lighting; general car inspector, and divisional car foreman, Eastern lines. In 1913 he became master car builder of the Canadian Government Railways (now C. N. R.), at Moncton, N. B., and in 1918

George E. Smart

was sent to Toronto, Ont., as general master car builder of the Canadian National. In 1920 Mr. Smart's jurisdiction was extended to include the Grand Trunk Pacific lines and later in the same year he became mechanical assistant to the operating vice-president. In 1923 he was appointed chief of car equipment, with headquarters at Montreal. Mr. Smart served as vice-chairman of the Mechanical Division, American Railway Association, from 1926 to 1927, and as chairman from 1928 to 1930.

Trade Publications

"DYN-EL."—Alan Wood Steel Company, Conshohocken, Pa. 46-page, paper-bound booklet descriptive of Dyn-el, a new high-strength flat-rolled steel with unusual resistance to fatigue, impact and corrosion. Tables and diagrams.

◆

LATHES.—The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Bulletin No. 11-19 R. P., "Doubling Production per Hour," 438. Describes heavy-duty, rapid-production lathes and illustrates a number of forms of tool set-ups.

◆

METALSPRAY.—Bulletin 800, issued by the Metalspray Company, Incorporated, 113 Llewellyn street, Los Angeles, Calif., briefly describes some new applications of Metalspray, a method of spraying molten metal on all materials. Copper is used in the printing of this circular as pertinent to the subject matter.

◆

MONEL GASKETS, PUMP PARTS, VALVE TRIM.—The International Nickel Company, Inc., 67 Wall street, New York. Six-page bulletin. Applications of Monel rods and cylinder liners, Monel plungers in high-pressure pumps, Monel valves, etc.

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

STEAM DROP HAMMERS.—Erie Foundry Co., Erie, Pa. Bulletin No. 325; 23 pages. Pictorial description of the design, construction and operation of the Erie steam drop hammers.

◆

ARC WELDERS.—General Electric Co., Schenectady, N. Y. Booklets GEA-1440G and GEA-1750D. Type WD single-operator arc welders and Type WK a.c. welders, respectively.

◆

RAIL WELDING.—Metal & Thermit Corporation, 120 Broadway, New York. Pamphlet 117, "Continuous Rail for Main Line Track." 30 pages. Describes the history of rail welding throughout the U. S. and Europe and illustrates installations on the D. & H. at Schenectady, N. Y.; the B. & L. E. at River Valley, Pa., and the Northern Pacific at Elliston, Mont., and Livingston.

WROUGHT STEEL WHEELS.—American Iron and Steel Institute, 350 Fifth avenue, New York. Steel Products Manual, Section 20; 14 pages. Describes briefly forging and rolling of wrought steel wheels for steam- and electric-railway service and for industrial purposes, and defines technical terms relating to their heat treatment and machine finishing.

◆

RAILWAY AIR CONDITION EQUIPMENT.—The Trane Company, La Crosse, Wis. Bulletin V258. Contains a 28-page exposition of the Trane system of electro-mechanical air conditioning, primarily for car installations; descriptions of convectors used in house heating and of multiple-type projection heaters, and a general catalog of Trane products.

◆

JOURNAL BEARINGS FOR RAILROAD SERVICE.—SKF Industries, Inc., Front street and Erie avenue, Philadelphia, Pa. 40 pages. A description of SKF spherical roller bearings and a photographic history of the more important installations in the United States and Canada on car and locomotive journals of both steam and electric types.